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TELEPHONIC COMPETITION.

Ever since the fundamental Bell telephone patents ran out there has been a rising tide of opposition and competition, and while occasional recessions have happened, each wave has rolled forward bigger and fuller than the last. The extent of the "independent" telephone movement is not known very exactly, save most probably to the Bell people themselves, who have never yet been found wanting in any respect of that kind and have never spared money when it came to preparations for fighting an enemy. We may perhaps assume that there are about 250,000 subscribers connected up with between 2000 and 2500 independent exchanges, the vast majority of these exchanges being little affairs run on a co-operative plan or not seeking to make a profit, which would indeed be impossible at the rates charged. In some sections of the country these exchanges are pretty plentiful. In Michigan their value is set down at about $1,275,000, or more than the Bell interests in that state, there being one excellent large exchange at Detroit, 30 rated at $5000 and upward and 35 at from $500 to $4000 apiece. In others parts of the country such as Iowa, Indiana and the south they have multiplied of late very rapidly, while in Massachusetts and Connecticut they have nearly all died out or gone under the hammer or been absorbed by the "old line" Bell system.

The rates charged by most of the independent exchanges have often been enough to kill them, but what has been a serious evil is the lack of such a long-distance network as is given to the Bell system by the superb lines of the American Telephone & Telegraph Company. Thus the numerous good opposition exchanges have stood alone in costly isolation and a great deal of effort and thought has been expended not merely in connecting toll lines but in trying to get long-distance lines. But the investment is no light burden. We are within the figure in putting the Bell long-distance outlay up to date at $15,000,000.

Against this rock the tide of independent telephony might long have chafed in vain but for the creation, as noted in our pages last week, of the Continental Telephone, Telegraph & Cable Company, whose leading spirits are such men as Messrs. Widener and Maloney and some of their associates, who have already reorganized and solidified so many electric lighting and street railway properties. The financial prestige and industrial successes of these men are on a colossal scale and cannot be minimized. One can only wonder sometimes how they find hours enough in the day to foster such a multitude of useful and prosperous enterprises. Their advent into the field of telephony must mean a great deal to that art and would, it seems, affect the sister art and industry of telegraphy. In fact, it is rumored that Mr. George Gold now sees his chance for the Western Union system, and the prospect opened up does indeed seem inviting in many respects.

The telephone field is by no means fully developed in this country, and might, it is estimated, be doubled or trebled in the number of instruments in use. The income is large from the Bell service as it exists and should be anywhere from forty to fifty millions a year. Last year there were 1,231,000,000 Bell telephone messages at an average cost of between 1 and 9½ cents. Averaging these at 4 cents

would give not far short of $50,000,000 for the year. But the use of the telephone from house to house, from farm to town, in hotel, factory and office is still infinitely short of what it ought to be. Just how far the new opposition will help to develop the field it is not easy to define just now, but it is obvious that with any real competition the business may be enormously developed with concurrent gain to the public. But we shall doubtless hear less of Bell greed and grasping. The new set of men are not in business for philanthropy or their health. They rank as the shrewdest exploiters of industrial enterprises this country has seen in a long time, and they go into a thing primarily to make money. Many of the opposition telephone companies have started out on a platform of redressing a grave public grievance, but if they avail themselves of the undoubted benefits of the Continental connection, they will be brought down to solid earth very quickly. Whether there can exist two great telephonic networks in this country, we will not undertake to say. It is often argued and assumed that there cannot. The Bell system has given signs of merging into one big concern, with a capital of, say, $300,000,000, the better to handle its business, and the subcompanies have gradually lessened in number or importance, although they are all related and coworking. The Continental can now mass together an opposition of $100,000,000 to begin with, if the "independents" are willing, and many of them seem to be. In fact the fight is already on, and its progress bids fair to be one of the most interesting parts of electrical development in the immediate future.

Marconi Departs.

Marconi sailed from New York this week in order, his press agent reports, to assist British operations in South Africa by means of the wireless telegraph. The experiments on his system which have been conducted recently under government supervision were left uncompleted, but it appears that the scope of these in any event would have been much circumscribed. In a final letter to the Naval Board having charge of the experiments, the statement is made that "Having consulted with my partners, I regret to be unable to give a demonstration of the devices I use for preventing interference, and of the means I use for tuning or syntonizing the instruments"—the reasons given being that the means are not completely patented and protected, and the necessary material and apparatus were not brought to this country. The letter also asks that the results of the naval experiments be not regarded as a test of the system, as the instruments used are claimed to be of an early type intended only for short-distance work. If the visit of Marconi has resulted in no additions to our knowledge of wireless telegraphy, on the other hand his managers have shown that they have nothing to learn from Yankeedom as to the art of commercial exploitation of an inventor and his inventions.

Protection of Interior Wiring from High-Potential Currents.

In an article in our issue of Oct. 28, Messrs. Reed took the ground that a low-pressure circuit could not be adequately protected from high-pressure crosses by grounding it at some point, in the manner proposed at the Boston convention of the American Institute of Electrical Engineers last summer; and that in order to give adequate protection it would be necessary to disconnect the house wiring as soon as its potential reached a predetermined safety limit. Dr. Hutchinson replied to the communication in last week's issue, and the present number contains an article on the subject by Mr. W. L. R. Emmet.

It seems to us that the arguments of the article are based upon unpractical conditions. Broadly speaking, if a low-pressure circuit has a working potential difference of, say, 100 volts, and one point in this circuit be permanently grounded, no part of the circuit can be maintained at a potential much in excess of 100 volts relatively to the ground. Any excess must be due to drop of pressure in conductors, and such drop must represent a corresponding strength of current from the crossed high-pressure circuit. If the current capacity of this intruding circuit is no greater than the low-pressure circuit to be protected, the drop cannot be very large. On the other hand, if the current capacity of the intruding system is large by comparison with that of the low-pressure system considered, the current to ground through the latter may produce a comparatively large drop, but will at the same time be likely to make the disconnection Messrs. Reed require, by melting the fuses of the low-pressure circuit.

No protective device can be conceived of which will be infallible, and only such a device should be used as will be reasonably simple and reliable. Nothing can be simpler or more reliable than a permanent ground behind a fuse. It seems to us that every low-pressure circuit in houses should either be permanently grounded, or else should be protected by some device which can be depended upon to ground the circuit instantly when contact with an intruding high-pressure circuit takes place.

Electrolysis of Buried Pipes by Electric Railway Currents.

We frequently read sensational descriptions in the daily press of the devastations which is being effected upon buried gas and water pipes by the terrible and havoc-making currents that trolley systems let loose in the confines of the earth. Some of these descriptions suggest the raid of an Apache scalping party upon the tranquil settlers' outpost home, rather than the blind servility of an electric current whose stream obeys Ohm's law. There is no disputing the fact that street railway system return currents have produced marked electrolytic corrosion in buried pipes, and that the evil may assume a serious aspect under certain conditions of pipe distribution in city streets. On the other hand, there is every reason to believe that the injury has been greatly exaggerated in many of these lurid newspaper reports, and, also, that the injury may be so far reduced by the exercise of proper precautions as to be practically eliminated.

The source of the trouble lies in the imperfect bonding of the rails, whereby the electric resistance of the track becomes relatively so considerable that return currents are forced into the ground, and, therefore, into or out of metallic pipes buried within the ground. We believe that if the rails of an electric street railway system were continuous, or continuously welded or properly bonded, and this electrically continuous track system connected to the return bus bars by suitable heavy conductors, that all danger of electrolysis in buried pipe system can be overcome. On the other hand, if the track bonding is so imperfect as to force a considerable amount of current into the ground on its way back to the central station, then it would seem that electrolytic effects on neighboring buried iron can hardly be avoided, and the only question is how much electrolytic corrosion may, under the circumstances, be expected.

The most serious danger in such cases is always to buried, lead-covered telephone cables, because their leaden sheathing is continuous and without joints. Such cables may lie parallel to the track for long distances and be subjected within such distances to fairly considerable differences of electric potential; namely, to the drop of pressure in a return system, owing to their relatively great conductance. Nearly all of this potential difference is likely to be developed between cable and the track at the two ends of its length—the end near the station, and the end remote from the station. At one or other of these locations, depending upon the direction of trolley current, the difference of potential will probably establish a

steady electrolytic action that may soon corrode through the cable sheathing. In such cases the remedy is to connect the cable sheathing electrically with the ground-return system, so that the current cannot escape from the sheath except by metallic conductors, and, therefore, cannot set up electrolysis. In other words, the electrolytic plating bath is short-circuited by a wire.

In the case of buried gas and water pipes, the mains have frequently large diameters and ample conductivity to act in the same manner, but they have numerous joints which are electrically imperfect. In other words, the mains are in sections that are necessarily imperfectly bonded. On this account, the aggregate resistance of a length of mains is very considerable, and when a main parallels an electric road, the difference of potential between the central station and the remote portion of the track is expended at all of the joints in the pipe, in such a manner that only an extremely feeble electrolytic current can flow. In other words, the current will not be tempted to pass through the mains to any considerable extent unless the potential difference acting is comparatively great. Of course, considerable damage may be done to a main by currents entering and leaving it under local conditions. Such cases of injury have come to light, but they are exceptional, and a mile of gas or water main is electrically very different from a mile of lead cable in regard to resistance, which is offered to conduction in each case. Consequently, it is of very little use to connect a gas or water main to the return system, except to avoid local conditions.

The real danger of gas and water pipes lies in the service pipes which are run from the mains and which pass in the neighborhood of the railway tracks. Such services have screwed joints, are practically electrically continuous conductors, and offer tempting paths for current to flow when they bridge places of appreciable electric difference of potential. Although the actual current strength emerging from the surface of such a service pipe may be very small, yet in the course of months or years the total electrolytic effect and corrosion may be considerable. The local remedy in all such cases is, of course, to keep the service pipes as far from the track as possible and to insulate them as well as possible from the soil in which they lie. The general remedy is of course, to improve the track bonding to the extent of affording ample conduction for the return currents, with so small a drop of pressure that no large amount of current will be deflected into and out of the ground. This not only reduces the danger of electrolytic corrosion, but also improves the efficiency of the conducting system, and reduces the electric losses in the power transmission. It is because the pressure is expended idly in conducting drop that it becomes vicious in its propensities, and when almost wholly consumed in the counter electromotive force of the car motors, the current may properly be considered too busy to attend to neighboring pipes.

DYNAMOS DELIVERING SIMULTANEOUSLY HIGH-VOLTAGE ALTERNATING AND LOW-VOLTAGE DIRECT CURRENTS.

In the combined polyphase and direct systems of power transmission and distribution now common for both extensive central station and long distance railway equipments, it is necessary to make two transformations of the power to obtain the low-voltage direct current from the high-voltage alternating current, or vice versa. One of these two transformations is a change of direct into alternating currents, or vice versa, of nearly the same pressure, accomplished in machines with moving parts, called converters. The other is a change of the alternating currents of low voltage into the same of high voltage, or vice versa, in machines with no moving parts, styled transformers. A similar double equipment of apparatus must be used in generating stations attempting to obtain both kinds of current from one type of machine. In this case the machine delivers direct current at the voltage at which it is used, but must from the nature of its construction deliver the alternating current at a voltage much below that desired, requiring step-up transformers. For this case Mr. Alton D. Adams, in an article appearing on another page of this paper, proposes to use generators having two windings, one for the low-voltage direct current and the other for the high-voltage alternating current, and so connected as to generate this high voltage direct, doing away with the need of transformers.

While at first sight this appears to be a highly desirable and easily accomplished result, a slight study of the question discloses practical difficulties which will no doubt prevent the use of machines wound in this way. The fundamental objection to such a machine is the fact that two separate and electrically independent windings of the armature (which must necessarily be the revolving member) are necessary. The alternating current from machines of this character is generally intended for long-distance transmission at a pressure of 5000 or 10,000 volts or more. The direct generation of this voltage requires the bunching of the alternating current windings in large slots, giving room for ample insulation between the copper and the iron. A finely distributed winding in many slots per pole appears out of the question, since the slots would necessarily be so narrow that insulation of the necessary thickness would completely fill them, leaving no room for copper. On the other hand, direct-current machines require the distribution of the winding in a large number of slots per pole, generally many more than those customary in alternators of moderate voltages, which in turn are more than those customary in high-voltage machines. Thus the direct-current windings should be distributed in from two to ten times as many slots as those containing the alternating-current winding, this ratio varying according to the size, distance between poles and voltages of the two outputs.

Under no consideration, however, should the high-voltage alternating current coils be contained in the same slots as the low-voltage direct-current windings, since there would with such a construction be the risk of a breakdown of the insulation between the two windings (which insulation would necessarily be thin owing to the cramped location) and the consequent introduction of high alternating potentials on to the direct-current system. If many narrow slots for the direct-current winding were interspersed with or sandwiched between large and comparatively few slots for the alternating-current winding, the difficulty of finding room for the insulation of the latter would be rendered still greater. The construction that would have to be adopted would probably be that used for another purpose in some foreign machines, viz., distributed parallel-sided slots near the surface of the armature for the direct-current windings, and a few large tunnels for the alternating-current windings deeper down below these slots. This would require hand-wound alternating-current coils, expensive to construct and difficult to repair or replace, and which have great magnetic leakage and other disadvantages. Mr. Adams also points out the fact that the alternating-current output, if single-phase, can be generated by conductors distributed over only half the armature surface, the rest of which can be used for the direct-current winding. It is hardly necessary to point out that in the first place the alternating-current output of such machines is and would be almost invariably polyphase; and in the second place, even if it were not so, a direct-current winding must be distributed uniformly over the whole of the armature surface. If it is really necessary to do away with the transformers, Mr. Adams and others had better use a direct-current machine coupled to an alternator and not attempt to meet too many conflicting requirments in one armature.

The Promise of a Big Independent Telephone Opposition.

Last week we noted in our financial columns the vague reports then in circulation as to a new opposition telephone system. There have been so many of these schemes and movements, they have come to be regarded by the public with a great deal of scepticism, but it was inevitable that sooner or later something tangible should evolve, and the present time has appeared to those who are interested to be appropriate for the launching of the enterprise. As we noted last week, the list of those who are more or less to be numbered among the promoters of the Continental Telephone, Telegraph & Cable Company includes particularly Messrs. Maloney, Widener, Elkins and Whitney. So far as now disclosed, the active spirit of the enterprise is the indefatigable Mr. Martin Maloney. The actual officers, whose headquarters are at 100 Broadway, New York City, are Mr. W. J. Latta, president, and Mr. George W. Beers, secretary. The former was general agent of the Pennsylvania Railroad Company and has lately been engaged in electric lighting consolidations in Philadelphia. Mr. Beers, of Fort Wayne, Ind., has long been prominent in independent telephone work, and knows that field, as well as the men in it, very thoroughly. It is said that for some reason or other the name of the company will be changed from "Continental" to "National," and that its capital will be $50,000,000. It is further rumored, as noted last week, that Mr. George Gould is in line and that the Western Union Telegraph Company looks on with a friendly feeling that may be shown actively, the underlying motive being a desire to recoup the losses that have been inflicted on the telegraph by the growth of the telephone and by the cessation of the 20 per cent. royalty once received from the American Bell Telephone Company. It is also said that the Western Union Company no longer has its former large holdings in the New York Telephone Company.

As to the plans of the new company, these are by no means fully or clearly formulated. One plan that is well authenticated is that of building a long distance line from Boston to New York and thence to leading Southern and Western points. Around this nucleus the two or three thousand independent companies are expected to group, and several of the larger ones are understood to be already in line. As a matter of fact, very few large cities have yet an anti-Bell system. Detroit and St. Louis are the best examples, and in Chicago the Strowger people have got ready for business. But in New England, all the independent telephone companies have practically faded out of Massachusetts, while in Connecticut only those of Ansonia and Winsted remain. In Boston, there is a new company which is not yet ready to give service, and the same is true of New York City, where the People's and the Knickerbocker Companies have done considerable preliminary work. The new opposition has to use for its offices the service of the local Bell service (New York Telephone Company), and is at its mercy so far as the tapping of lines is concerned, in regard to any business emanating directly from or going to 100 Broadway. Discourtesy is already complained of. Hitherto, the Bell Company has had a monoply of the subways for telephone work in New York, but there are abundant spare ducts belonging to the Metropolitan Street Railway system under Whitney control. While outside of Boston and New York, rival independent telephone systems do not exist in many large cities, several companies have been projected. It will probaly require a year or two to get even a few of them in operation.

A number of points of interest arise in connection with this formidable movement. One of them relates to patents. The Bell system of to-day, while it has lost by lapse of time its fundamental Bell patents, and puts forward the Berliner transmitter patents as a substitute, has behind these a vast collection of other patents relating to an endless variety of details of operation and construction. What the value of these is may now be demonstrated. Some of them of real importance, such as the Carty bridging bell, have already been sustained by the courts, and there are others of scarcely inferior significance. On the other hand, a host of manufacturing companies has lately sprung up, and most of them are turning out large quantities of apparatus without "let or hindrance." The attempt last spring to bring together in one combination a number of these independent manufacturers resulted in failure, but the game is still in its early stages.

Another point of interest lies in the personnel. It will be impossible to organize an independent opposition of the proposed magnitude without securing some of the talent and experience that has been developed within the Bell service, and it will certainly be interesting to see how far the esprit de corps or good salaries will keep the ranks intact.

In addition to the new and imposing independent movement which has thus made itself felt so suddenly, there are other schemes and plans afoot. During the past month, the Federal Telephone Company was organized under the laws of New Jersey by that master of trust law, Mr. J. B. Dill, and there are also the Strowger interests, and those of the United States Automatic Telephone Company, owing the Ries patents, in which Mr. E. McCall, of the New York Life Insurance Company, is a director.

With regard to the specific conditions of telephone service in New York City, it is said that when ready the new company will furnish unlimited use at $100 a year and 1000 messages at $45.

It has been suggested in some quarters that, after all, the present scheme is but a deep move worthy of the Bell strategy of bygone years, and is intended by manœuvres more or less direct to gather together the various independent concerns that have exhibited real vitality and absorb them into the existing network, in due course, leaving the telegraph and telephone in an unseparable unity or in two large corporations. This idea does not find much acceptance, however, at the present juncture, and the newspaper comments take it for granted that the public is to benefit by a general reduction of rates.

A feature of the situation that has escaped notice is the fact that the Erie Telephone & Telegraph Company, while virtually a Bell suborganization, is ostensibly free and independent, so that if it were bought out, it would make a deep gap in the Bell ranks over large sections of the country. There are no signs of defection in the Erie at this moment.

The list of stockholders is given as follows: P. A. B. Widener, W. L. Elkins, Thomas Dolan, Martin Maloney, John Jacob Astor, Charles R. Flint, George F. Baker, A. L. Barber, Henry M. Whitney, of Boston; William H. Crocker, of San Francisco; former Gov. Francis, of Missouri; Francis M. Jencks, Emerson McMillin and Corant B. Schley. The name of Mr. W. C. Whitney has also been freely mentioned, but there appears to be no definite certainty about it. The name has also been mentioned of Mr. Samuel Insull, of Chicago, and of some others well known in the electrical field but not heretofore identified with telephony.

With regard to the purchase of some of the existing independent telephone companies, a special despatch from Trenton, N. J., of Nov. 6, says: There was a meeting of the stockholders of the Home Telephone Company of this city this afternoon, and by vote they refused to ratify the sale of the company to Kepler & Walker, of Philadelphia, who are supposed to represent the new Continental Telephone, Telegraph & Cable Company. Samuel K. Wilson, a millionaire manufacturer of this city, controlled 6644 shares of stock out of the 15,000, and when he cast his block of stock against the ratification it decided the matter. It requires a three-fourths vote to ratify the sale.

As to the effect of the Berliner patent, a special despatch from Boston of Nov. 7 says: An important issue is involved in the suits of the American Bell Telephone Company against the National Telephone Manufacturing Company and the Century Telephone Company, which came up for final hearing to-day before Judge Brown in the United States Circuit Court. The issue related to the validity of the so-called Berliner patent. The case has been pending for several years. The actions are of an equitable nature, and seek relief from the alleged infringement by each of the defendants of the letters patent 463,569, dated Nov. 17, 1891, and issued to the complainant as assignee, Emile Berliner. It is contended by the defense that the Berliner patent is invalid, while the complaint maintains that the patent is valid and the defendants have infringed upon it.

With regard to the new Federal Company, a special despatch from Cleveland, Ohio, of Nov. 5, says: The Federal Telephone Co., recently organized in New Jersey with a capital stock of $10,000,000, proves to be a Cleveland organization backed by H. A. Everett, E. W. Moore, J. B. Hanna, John Sherwin, Charles L. Pack, B. Mahler, R. A. Harmon, James B. Hoge, C. W. Wason, H. C. Ford, and others. H. A. Everett is president, E. W. Moore, vice-president; James B. Hoge, secretary, and John Sherwin, treasurer. The object of the company is to unite the independent telephone companies of Ohio, Indiana and Michigan, make their services better and cheaper, extend their lines, and establish a long-distance service.

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The Light and Power Plant of the California Powder Works.

By Wyatt H. Allen.

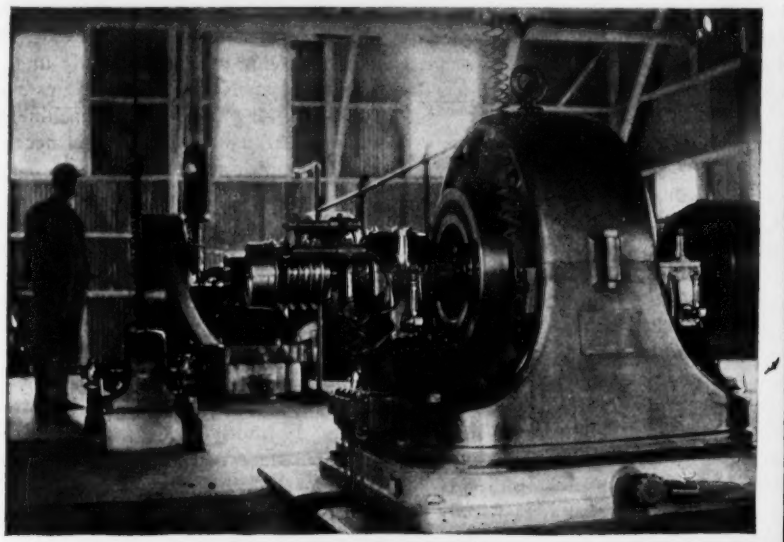
TO the California Powder Works belongs the distinction of being the largest establishment of its kind in the world, not alone in the actual ground space covered by its numerous buildings, but in output as well. That portion of the plant in which the manufacture of explosives is carried on is situated on the easterly shore of San Francisco Bay, near the small town of Pinole, and adjoining the right-of-way of the Southern Pacific Railway.

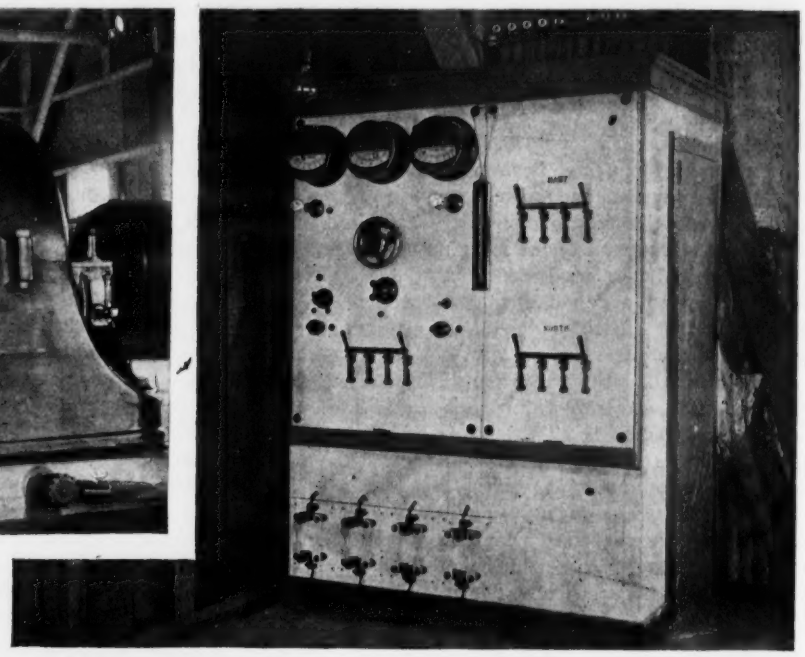
Owing to the nature and magnitude of the works, a large area is dotted with isolated buildings radiating from a central group, where less hazardous operations, such as the manufacture of acids, etc., take place.

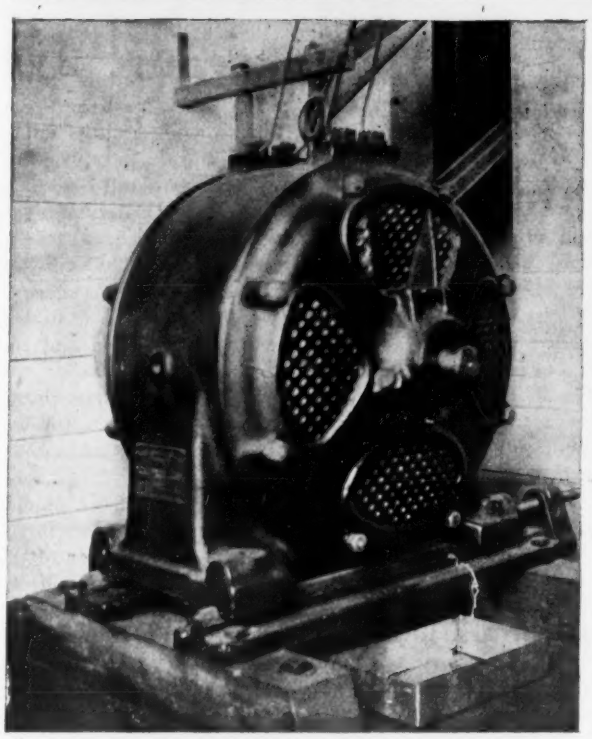
lamps for oil lanterns. Exhaust steam is indispensable about the works, and for this reason a few small engines are still retained, though the capacity of the electric plant is now being trebled, not yet a year from the date of the initial installation.

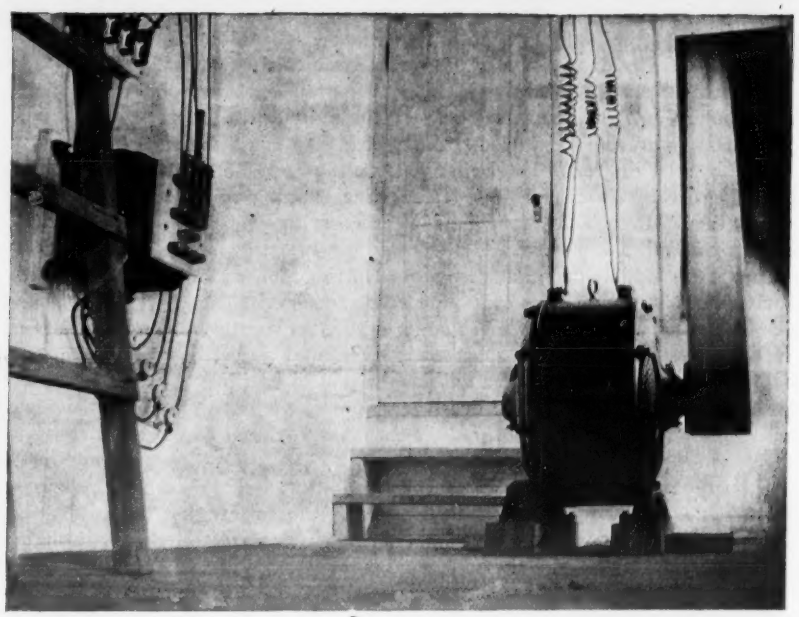
The power-house is situated on the edge of the water across the railway tracks from the works. It is a wooden frame building, about 50 feet square, the roof and walls being covered with corrugated, galvanized iron. A horse railway track passing close to the main door facilitates the handling of machinery from the company's wharf, and the roof trusses are constructed in such a manner that a chain block may be used to advantage within.

The boiler equipment consists of four horizontal tubular boilers made by the Atlas Engine Works, working at 90 pounds pressure and having an aggregate capacity of 310-hp. An additional 100-hp unit is to be installed in the near future. Oil is burned in the fur-









FIGS. 1, 2, 3 AND 4.—ELECTRICAL APPARATUS IN THE CALIFORNIA POWDER WORKS.

No water power being available, the entire plant was operated by steam delivered to small engines, the number of which together with long lines of steam pipes and corresponding losses by condensation, had increased with every new building or addition, until, in the summer of 1898, the company decided to install an electric light and power plant. A more nearly ideal opportunity for the application of electric power would have been difficult to discover at this time, though it was thought best to commence the transformation in a comparatively small way, gradually replacing the many inefficient engines and steam pipes with motors and substituting incandescent

naces, being fed to the burners by a gravity system from a common reservoir, steam being injected at the burners, serving to vaporize the oil rapidly and adding the necessary amount of oxygen for complete combustion.

The smoke flues rise vertically to a common header running parallel with the front of the boilers, and this in turn is connected by two long flues, extending back through the wall of the house, with two 40-foot stacks, each four feet by five feet in the clear, situated on an elevation 20 feet above and about 100 feet to the rear of the power house.

Because of the poor quality of water in the vicinity, and as an economical measure likewise, the feed water used at the power house is caught in a sump from the condensation of exhaust steam in the heating coils at the gun-cotton plant, and pumped into a hot well on the elevation back of the station, from which it flows by gravity into a feed-water heater and is thence fed to the boilers by either one of two Worthington steam pumps.

The hot well is unique in its appearance, being built of several iron tanks, or drums, in which the company imports glycerine. These are interconnected and receive the condensed steam from the condenser, as well as from the sump previously mentioned.

A Deane steam pump in the boiler room forces 40,000 gallons of salt water hourly against a 50-foot head, from the bay into a reservoir located at the highest point on the grounds, and it is from this reservoir that the cooling water is led by a gravity system directly into the condenser pit to a surface condenser fitted with a duplex air and circulating pump which forces the water back against the Deane pump into the main pipe leading to the reservoir. The condenser pit, located under the engine room floor, is at present being enlarged to hold an additional condenser for use in connection with another engine.

In the engine room a 100-hp tandem-compound Ball engine, running at 270 r. p. m., drives by belts a 60-kw two-phase alternator, giving 7200 alternations and 440 volts at 900 r. p. m.; its exciter, of multipolar type and 2-kw capacity, gives 125 volts at 1800 r. p. m. A 150-hp tandem-compound Owen's engine has recently been installed, and will be belted to a 120-kw alternator and its exciter. The engines and dynamo are bolted to solid concrete foundations, the engines being grouted with sulphur, while the dynamo foundation is capped with a neat wooden platform.

The switchboard is in two panels of polished white Tennessee marble, mounted on iron framework, and is of the well-known Westinghouse type, as is all the electrical machinery in use at the powder company's plant. One panel contains the usual measuring instruments—an ammeter in each phase and a voltmeter indicating on either phase by means of a plug switch; hand wheels for controlling the field rheostats, which are mounted on the back of the board; two enclosed-break field switches; a ground-detector outfit and one four-pole main switch. The second panel contains two four-pole, quick-break feeder switches on the two circuits leading out of the station.

The connections between the generator and switchboard are laid under the floor of the station in insulating tubing. From the back of the switchboard both two-phase, four-wire circuits rise vertically to the tie beams overhead, along which they are strung on heavy porcelain knobs and are led out at the rear of the building to a forty-foot pole heavily braced and guyed, from which they cross the railway cut, a span of 165 feet, to a similar pole on the opposite bank of the cut. Here the two circuits divide, one line running south and the other east. Both are about half a mile in length, and are throughout of four No. 3 B & S bare copper wires, strung fourteen inches apart on double-petticoat glass insulators mounted on oak pins driven into a single four-foot pine cross-arm and secured by a nail. The poles are of squared redwood, 20 feet in length and set 110 feet apart in line, 90 feet apart on curves, and 5 feet in the ground, the lower end being coated with asphaltum to two feet above the ground. The gains, pins and cross-arms are painted with P. & B. paint, and the cross-arms secured in the gains by two through bolts.

To supply current at 110 volts to the 16 and 25 candle-power lamps, of which about 400 are now in use, transformers, ranging in capacity from 10 to 80 lights, are set, wherever necessary, on the poles, and tap the mains on alternate phases so as to equalize the lighting load between them as nearly as possible. Wherever such arrangement is convenient, one transformer is used to supply several adjacent buildings, lessening the number of transformers and giving a higher efficiency. Clusters of four lights mounted on iron goosenecks with hood-reflectors are secured to the poles wherever it is necessary to light the grounds about the works. Switches for these lights are contained in small tin-lined boxes on the poles, so that they may be turned on or off at will by the watchmen. In the proximity of a transformer the four lamps are connected in multiple, but where distant they are connected in series across the 440-volt mains. Several portables carrying four lamps, connected for use in the last mentioned manner, are constantly kept at hand for use in emergency work at night at any part of the works. They can be quickly connected to the mains and have several times rendered valuable service.

All secondary wires are rubber covered, and strung on porcelain knobs and cleats. In one or two of the dwelling houses only is there any concealed work; and where any especial care is involved the switches and fuses are placed outside the buildings in small boxes.

To prevent the action of acid fumes on the insulation of wires in several buildings, it was heavily coated with an "acid proof" paint, this being repeated at intervals, and after a year it appears to be in perfect condition. For the same reason porcelain lamp sockets were used almost exclusively.

In the gun-cotton drying rooms the insulation is exposed to a very high temperature, and careful heat tests were made on a number of samples to determine which was best suited to the work in hand.

Twelve Westinghouse 440-volt induction motors, ranging in size from three to 20-hp, are now in use in different parts of the works. They are connected across both phases of the four-wire circuit in the usual manner, through a motor-starter, four-pole switch and fuses. Owing to their simplicity of operation, no trouble whatever has been experienced in placing them in charge of men totally unaccustomed to handling electrical machinery. None of the motors are direct-connected, as the location of counter-shafting and machinery does not lend itself readily to such an arrangement, and it is necessary in nearly every case to place the motor in a separate room or compartment on account of dust or acid fumes.

In the nitre house are two motors of 10 and 15-hp capacity, driving through belting and shafting five grinding mills, two nitre wheels, conveyors, blowers, etc.

A 3-hp motor is installed in the shell house, where the paper shells, which are later filled with dynamite, are manufactured. The motor drives a papercutter for slicing large bales of paper into sizes suitable for cartridges, and a wire rope conveyor, by means of which the finished shells are carried from the operators' tables to the dipping room to be boiled in paraffine. Formerly the paper cutter required three operators, and two men were constantly occupied in collecting shells and carrying them to the dipping room. With the present arrangement only one man is needed to feed the paper to the cutter.

The gun-cotton plant is composed of several buildings, some situated on an elevation at a distance of 40 to 50 feet above the others and connected with them by a belt-and-bucket conveyor driven by a 3-hp motor, serving to carry the raw cotton waste from the lower level to the tanks above, where it is dipped in acid. At the upper level the acid fumes are so strong as to necessitate the careful housing of the two motors there in use, in a separate room built especially for the purpose, the belts and countershaft pulleys being surrounded by a box into which fresh air from outside is introduced, the belts serving to keep up the circulation of air in the room. A 20-hp motor drives six centrifugal acid wringers, all belted to one shaft, and one of 10-hp capacity supplies the motive power to four similar driers. The acid-soaked waste is placed in the wringers by hand and the acid thrown off by centrifugal force, the wringers running at a speed of 1200 r. p. m. Both wringers and driers are constantly started and stopped, the starting torque being so heavy as to necessitate the use of larger motors than would otherwise be required, as when once at speed but little power is taken.

Isolated though they are, the motors, switches, etc., bear unmistakable evidence of the rapid action of the acid fumes, but fortunately the most important part of the equipment—the interior of the motors—is only slightly affected, due, without doubt, to the rapid circulation of air within the cases.

At the gelatine plant two 5-hp motors drive two mixers each, through shafting. The speed of the motors. is 1120 r. p. m., and that of the mixers comparatively low, the reduction being effected by variation in the size of the pulleys. All the machinery in the carpenter shop is driven from countershafting by a 15-hp motor, and in the box factory, two box-making machines are operated by one of 7-hp capacity.

The motor service alone constitutes the day load on the generating station, and at present it is carrying its full load continuously during the day, varying for short intervals to 20 per cent. overload. At night the greater portion of the motor service is discontinued, the lighting service taking its place to an extent which calls for less than three-fourths the capacity of the plant. A 120-kw machine lately ordered from the Westinghouse Company, is intended to carry the day load, which is to be largely increased, the dynamo now running taking only the night load until such time when the demand on the station necessitates the parallel running of the two machines.

The fact that some of the machinery used in the more delicate

operations of dynamite manufacture, must be driven at a constant speed, at first deterred the company from using motors in this connection. The regulation has proven so close, however, that no hesitancy is now felt in this regard. Both station and line were constructed with a view to the future enlargement of the plant, and this has since proven a wise precaution.

With the installation of the additional generator, the company contemplates the use of motors in the machine shop, in the sulphuric acid works for driving fans and blowers, on the wood pulp driers and possibly for driving the mixers in the nitro-glycerine house.

Warsaw, Poland, Central Station Plant—II.

THE GENERATING STATION.

THE station is located, as shown in Fig. 1, on the bank of the Weichsel, on the land occupied by the old waterworks on the Dobra. It faces the Hochquaistrasse, which runs parallel with the Weichsel and on the north runs along the Karowastrasse.

The engine and dynamo room is designed for the reception of four steam engines of 1000-kw each and four of 2000-kw each, or for six steam engines each of a capacity of 1000-kw, and six steam turbines each of the same capacity, so that in either case there will be a total capacity of 12,000-kw. It is 328 feet in length and 78 feet in width.

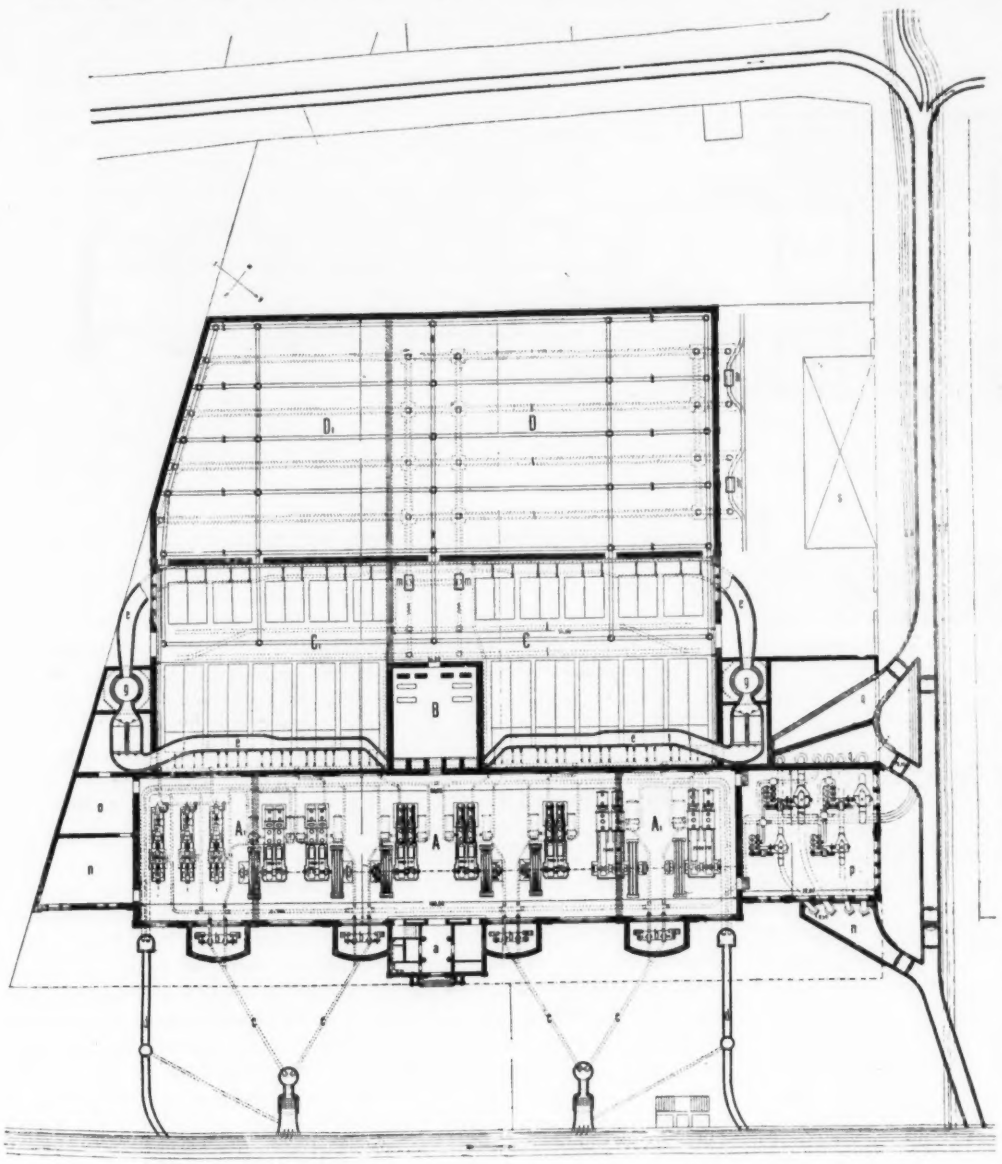


FIG. 1.—LOCATION AND PLAN OF CENTRAL STATION, WARSAW, POLAND.

The boiler house is built behind the engine room. It is designed to be equipped with 20 large tubular boilers to be arranged in ten groups of two boilers each, each boiler having a heating surface of from 1022 to 1076 square feet; and 20 water-tube boilers also in ten two-boiler groups, each one having a heating surface of from 2690 to 2790 square feet. The boiler house is 308 feet in length and 115 feet in width.

The pump room is located in the centre of the boiler house adjoining the engine room and has a total length of 55 feet and a width of 45 feet. It is equipped with feed pumps, condenser pumps, several transforming machines and auxiliary apparatus. At the ends of the boiler house are two extensions which contain economizers and in close proximity to these are two chimneys, each 13 feet in diameter at the base and 230 feet in height.

Right behind the boiler house and connected with the same by means of wall openings and tracks is the coal bin, which is 131 feet in width and has a mean length of 295 feet. Its capacity is 12,000 tons of coal, heaped to a height of from 15 to 16 feet.

A workshop and a room for the employees are located at the southern end of the engine room; the pumping station for the draining of the lower city borders on the northern wall. This room is 72 feet in length and 69 feet in width.

A small extension near the centre of the front of the engine room, 49 feet in width and 26 feet deep, is intended to receive the main and feeder switchboards. This portion of the building is made beautiful from an architectural standpoint as it forms the centre of the front of the main building.

The relative height of the various sections of the building can be seen by reference to Fig. 2. The floor of the engine room is built 20 inches above the high-water level of the Weichsel. To allow for the armatures of the large alternators, which have a diameter of 26 feet, it was necessary to build the foundation 15 feet below the engine room floor. The foundation which is built beneath the entire building consists of a layer of concrete of from 3 to 5 feet in thickness, in which ducts have been built for the reception of pipes.

THE ENGINE ROOM.

In regard to the equipment of the engine room, Mr. Lindley makes two propositions, both of which are shown in Fig. 1. At the right hand side of the figure all the prime movers are steam engines; at the left hand side one-half of the prime movers (6000-kd), are steam engines and the other half steam turbines. According to the latter plan the engines are installed for continuous service and placed therefore in the centre of the building, while the turbines are to serve as reserve during the few hours of demand on winter evenings, should that demand be in excess of the capacity of the engines.

This proposition has the following advantages to recommend it. The cost of production and distribution of electrical energy in cities consists mainly of the interest on and depreciation of the original capital and only to a small extent of operating expenses. In round figures it may be said that one-third of the total cost is interest on the capital, one-third is depreciation and one-third operating expenses, and that one-half of the latter or one-sixth of the total cost is made up of salaries, i. e., administration expenses which do not vary widely whether a small or uarge amount of energy is procured. The other half, that is, another sixth of the total cost goes toward the purchase of coal, oil, etc., i. e., expenses which depend on the amount of power generated. For continuous service, engines and boilers, requiring small coal consumption, must be installed, but in regard to those engines and apparatus which only act as reserve during the busy evenings during November, December and January, the prime consideration is low first cost and the coal and operating expenses are only secondary.

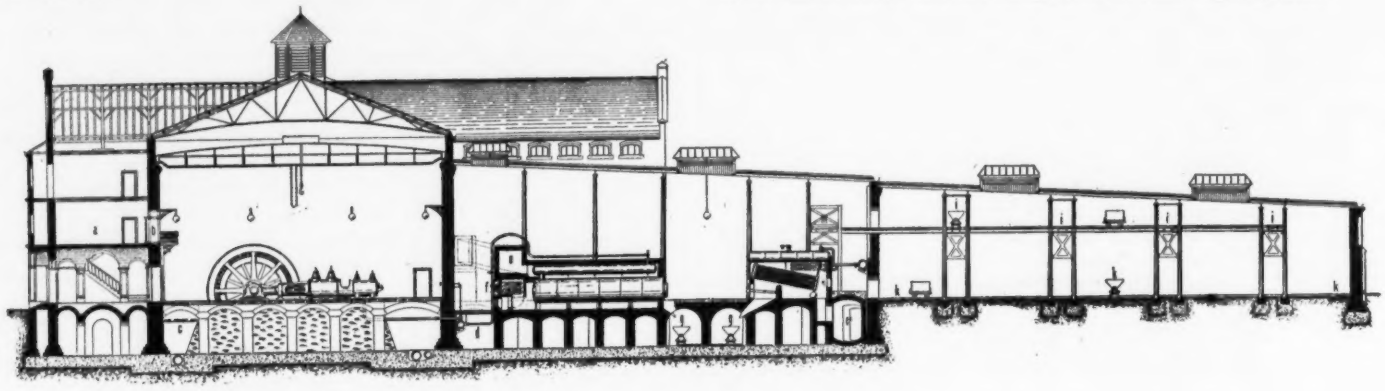
This object can be attained by the installation of steam turbines. In the first place the turbine is considerably cheaper than a steam

engine of the same capacity; in consequence of the high speed (1500 r. p. m.), and the alternator which it drives is correspondingly small and cheap. A steam turbine of 1500-hp is together with its alternator 44 feet long, 8 feet wide and 8 feet high, while an engine combination of this capacity is 49 feet long, 26 to 29 feet wide and 22 to 26 feet high; consequently, the turbine and the passageways at its side occupy less than one-half the space of the steam engine; besides, the turbine exerts a more even turning movement on the shaft which does away with the necessity of a heavy foundation.

The first costs of a 1000-kw steam engine and alternator and a steam turbine and alternator of equal capacity inclusive of boilers, engine and boiler rooms, etc., and the resulting yearly expenses are as follows in Warsaw:

	First Cost.	Yearly Expenses.
Tandem Compound Engine	$173,250	$20,920
Triple Expansion Engine	168,500	20,390
Steam Turbine	123,750	14,930

The comparative steam consumption, using moderately superheated steam, and at a load varying betwen one-half and full load, is as follows:



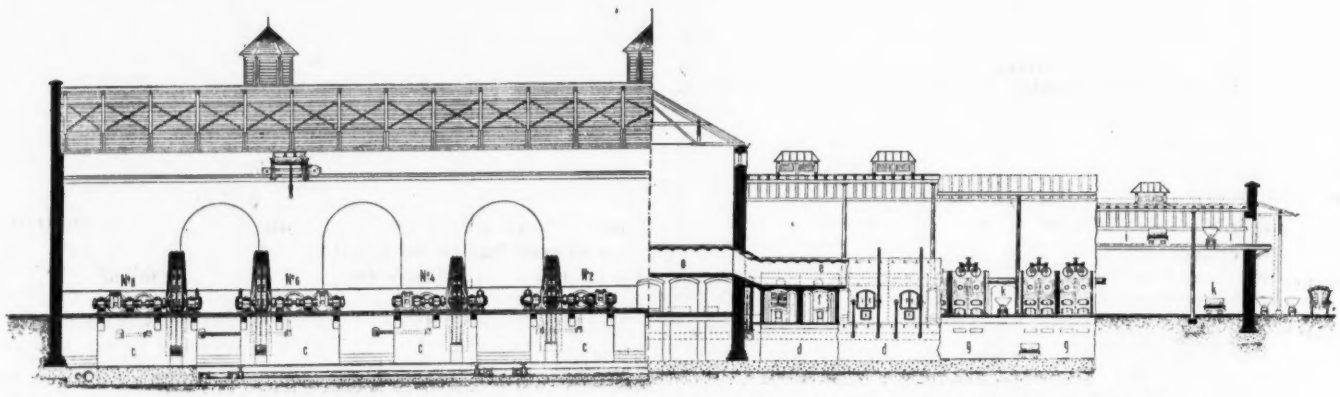


FIG. 2.—LONGITUDINAL AND TRANSVERSE SECTIONS OF CENTRAL STATION AT WARSAW, POLAND.

Triple Expansion Engine	22	Pounds of steam per effective kw-hour at the board.
Double Tandem Compound Engine	25.3	
Steam Turbine	28.6	

which gives for variable expenses (coal, etc.) per year:

Triple Expansion Engine	$5,830	per 1000 kw-hours.
Double Tandem Compound Engine	7,095	
Steam Turbine	7,590	

Plotting these results in the form of curves, it is seen that up to 3125 hours' service, the cost of production of electrical energy by using a steam turbine is less than with a triple-expansion engine and up to 6875 hours less than with a double-tandem-compound engine. But for the winter service, with which we are concerned at this point, the hours of service are less than the above figures and vary between 500 and 1000 hours. In this case the steam engine would cost $4400 to $5500 per year, that is, from 25 to 30 per cent. more than the steam turbine and would even be higher if the steam consumption of the turbine were still greater.

Furthermore, steam turbines possess the following advantages when used as reserve machinery: They can be started up, when necessity requires it, in a very short time without first having to be warmed up, like steam engines of this size; they are started by a simple opening of a valve which can be done by an ordinary workman and within a few seconds they attain their full speed; oil is only consumed at the bearings and at several sliding contacts, and there is no lubrication of interior parts, which are traversed by steam. In consequence of this the water of condensation has the purity of distilled water and can be used very advantageously for feeding water for the boilers.

The turbine is well adapated for the use of superheated steam on account of its construction and the absence of internally lubricated parts. The wear of turbines due to operation is very small and during idleness it is not exposed to damaging influences the same as steam engines with their large sliding surfaces and numerous valves and stuffing boxes.

Steam turbines have stood exacting tests and actual service for many years in sizes up to 700-hp and an agreement has been entered into between the City of Elberfeld and a manufacturing concern in which the latter guarantees to furnish two steam turbines of 1000-kw each which will not exceed the above-named consumption. These machines will have a speed of only 1500 r. p. m., so that it will be possible to connect them directly with a four-pole alternator and thus avoid any intervening moving parts which could cause losses and be dangerous at such high speeds.

In regard to the parallel coupling of the steam turbine driven alternators with those driven by engines there need be no fear. The turbines have an absolutely uniform speed of rotation; the steam engines designed for this plant will also have very large flywheels and by employing cranks set at 90 degrees or 180 degrees will have a very uniform speed. Besides, there are in actual operation to-day water turbines and steam engines driving alternators and connected in parallel which vary far more in speed than would be the case with steam engines and steam turbines.

In view of these facts and arguments, it is proposed to use steam turbines as reserve prime movers, but the station shown in Fig. 1 has been designed so that there is sufficient room for a complete set of steam engines in case it was decided not to use turbines.

STEAM ENGINES.

The engines for the 1000-kw generators have a capacity of fron 1200 to 1500 effective horse power and those for the 200-kw generators from 2400 to 3000 effective horse-power. The tandem system is proposed, either the double tandem compound with two

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high-pressure and two low-pressure cylinders each, or tandem triple-expansion engines with one high, one intermediate and two low-pressure cylinders. To insure economical arrangement it is proposed to generate current for light and power on the one hand and for the railway on the other by the same engine or engines throughout the day.

The triple-expansion engines and turbines are designed for a steam pressure of 180 pounds at the boiler and 160 pounds at the machines; the tandem compound for 150 pounds at the boiler and 135 pounds at the machine; and superheated steam at a temperature of from 420 to 450 degrees Fahr. The speed of the engines is 75 r. p. m. This somewhat slow speed was chosen on account of the large size of the units and the length of their continuous service.

CONDENSERS.

The engines are supplied with surface condensers and the circulating pumps are separated from the engines and located in niches below the floor. As the Weichsel water contains a great deal of sand and foreign matter the use of a direct-coupled air pump and injector condenser would be a constant source of danger. Centrifugal pumps have been chosen as they are least affected by foreign materials contained in the water. Surface condensers with separate centrifugal pumps have the further advantage that a vacuum can be formed instantly, enabling the large machines to be quickly connected in parallel, a case which may arise at any time when sudden darkness sets in. The circulating pumps are electrically driven, the necessary reduction of speed being obtained by means of gearing.

For condensing four pumps of 30 gallons per second capacity each had to be installed for the smaller machines, and four of 60 gallons per second capacity for the larger ones. The small pumps are each driven by a 20 effective-horse-power motor and each of the larger ones by a 35 effective-horse-power motor. As seen in Fig. 1 the pipes from the pumps go directly to each engine, and all the pumps are connected by a pipe 28 inches in diameter, so that any pump can be connected by means of a valve to any engine in case of necessity.

In case the river cannot supply the required water for condensation, the canal water from the pumping station which adjoins this plant may be used.

THE ALTERNATORS.

The alternators which are driven directly by the engines are each supplied with an exciter which is direct-connected to an extension of the shaft making each unit entirely independent. The high-tension induction winding is stationary on the rim of the armature and built up around the flywheel, the magnet poles with their exciter winding are radially attached to the rim of the wheel. The low-tension exciting current is led to the magnet coils by means of collector rings. The machines are built for 3000 periods per minute (50 per second), and for a speed of 75 r. p. m. must therefore have 80 poles.

From each generator four cables run to the switchboard, two for the exciter circuit to the regulating apparatus, and two for the high-tension current to the bus bars. As shown in the sectional view, Fig. 2, these cables are carried on insulators in the eastern duct under the engine room floor.

BOILERS.

The number (40) and size of boilers has already been referred to, and it should be stated here that in view of the above figures giving the steam consumption, the total consumption in this plant will amount to 264,000 pounds of steam per hour.

Each one of the large boilers can generate a maximum of from 4400 to 5500 pounds of steam per hour, so that five of them are required for each unit. Each boiler has its own superheater and a double connection with the main steam pipe so that either superheated or saturated steam can be delivered by the boiler. The water-tube boilers are intended to supply steam during the extra heavy demand in the winter months. These boilers are also equipped with superheaters, which in this case form an integral part of the boiler as they are to serve in their completness as reserve units.

STEAM PIPING.

The main steam piping is laid out on the ring principle, surrounding the entire boiler room and which by means of two cross connections to the right and left of the pump room, can be divided into two distinct ring systems. Each boiler is connected to the ring and from there a short pipe connects it with the engine. The piping is so arranged that the steam has only a short distance to travel from the boilers to the engines, which obviates to a large extent the loss of heat.

The eastern half of the piping, as shown in Fig. 2, is led under the floor of the boiler room along a pipe gallery next to the wall of the engine room. This wall is only pierced at eight places for the passage of the pipes. The pipe gallery may be entirely closed up so that it can attain a high temperature, reducing the heat losses of the pipes to a minimum. The superheaters are located in a chamber behind the large boilers as shown in Fig. 2, which space is traversed directly by the furnace gases. This is also shown in Fig. 1.

SMOKE FLUES AND CHIMNEYS.

The smoke flue is located above the large boilers and superheaters, which gives a free space in the gallery beneath the boilers for the steam pipes. The smoke flue for the small water-tube boilers is situated beneath the boiler room floor. The ring system has also been adopted in the arrangement of the smoke flues. Two chimneys of the dimensions already given are provided for the carrying away of the gases. Their location, with flue connections, are shown in Fig. 1.

ECONOMIZERS AND FEED PUMPS.

Between the smoke flues and the chimneys economizers are interposed using the heat which would otherwise be wasted, for the warming of the feed water. Each of the two smoke flues is connected with two economizers each with 200 to 240 tubes and a heating surface of from 2150 to 2580 square feet. They are located near the north and south walls of the boiler house, as shown in Fig. 1.

The eight feed pumps which supply the required 30,000 gallons of water each hour, take the water from the feed reservoir into which the condensing water is discharged, after the oil has been extracted from it. They pump it through the economizers and then into the boilers which it enters at a temperature of about 100 degrees. The pump room is sufficiently large for the future reception of additional direct-current auxiliary machinery, rotary converters, etc.

COAL BIN AND ASH DISPOSAL.

Located closely behind the boiler house is the coal bin which, in order to be certain that there be no interruption of service due to lack of coal supply, has a capacity for three to four months' coal supply for winter service. The maximum coal consumption of the station is during the three winter months about 3000 tons per month. The coal bin is designed therefore to hold 12,000 tons. As no siding could be built to the bin, street transportation of coal has to be relied on and at the north wall is a track for coal wagons. These dump wagons are supplied with coal from the street, are lifted by electric elevators and are carried along the coal bin on specially constructed tracks as shown in Fig. 1. Tracks are laid in the floor for the cars which convey the coal to the boilers, and are shown together with their turntables by dotted lines in Fig. 1.

For the disposal of slack and ashes an ash tunnel is built under the boiler room along each boiler front. In this tunnel or pit are tracks on which ash carts are run into which the ashes drop. These are run onto ash lifts and run into the court where the ashes are loaded into wagons.

Spanning the engine room is a traveling crane which is electrically propelled and has a lifting capacity of about 25 tons. The tracks for this crane are situated along the two walls 39 feet above the floor level.

Ventilation has been amply provided for both by the admission of air through skylights and by means of electric ventilating fans during the summer months.

The station is lighted by means of alternating-current arc lamps. Numerous incandescent lamps are placed near important parts of machines, at the switchboard and in the boiler room. The current for these lamps may also be supplied by a set of accumulators.

From the illustrations it will be seen that the entire station with its engines, pumps, boilers, wires, smoke flues, etc., is so arranged that it may be centrally divided into two entirely independent and separate wings and that each part can be operated independently.

Multiple Flashes and Dark Flashes of Lightning.

BY ELIHU THOMSON.

I notice on page 643 of your issue of Oct. 28 that under the heading "Multiple Lightning Flashes," there is given a classification of forms of lightning in which "dark lightning" figures. Permit me to say at the outset that "dark lightning" is a myth, due to contrast effects when seen by the eye, and to peculiarities of photographic plate sensitiveness when photographed. The mystery as to the photography of dark flashes was cleared up a considerable time ago by Clayden's experiments. Any one interested may now find in *Nature*, No. 1563, Vol. 60, Oct. 12, 1899, a review of the subject by Mr. W. J. S. Lockyer, under the title "Dark Lightning Flashes," with additional confirmatory evidence.

The effect is one due simply to well-known actions of a photographic plate during exposure and development. If a plate is subjected to diffused light and then exposed to a bright flash, the flash develops and gives in the positive a white streak. If, however, the exposure to the flash is *succeeded* by the exposure to diffused light, dark flashes result. Those familiar with the more minute phenomena of the photographic plate will recognize this property as an old friend or enemy in a new rôle.

In regard to "Multiple Flashes," my attention was first called to this subject about six or seven years ago, a beautiful example of a ribbon flash taken by Mr. Jennings, of Philadelphia, having been sent me. I suggested, in a letter to Mr. Jennings, that if the camera did not move during exposure, the effect must have been due to the wind shifting the path of hot air, during a succession of discharges. So far as I know, this suggestion as to the cause of multiple flashes was original with me at the time.

Within the present year I have had my attention called by Mr. W. J. Jenks to a set of photographs taken by Mr. Walter Sprange, of Beach Bluff, Mass., which give a most conclusive proof of the possibility of the hot air streak remaining unchanged even during a transfer by the wind over a distance of nearly five feet, or the space between two railway tracks. As the phenomenon occurred near my own home, I was able to meet Mr. Sprange and he kindly detailed the circumstances and promised to write them up and publish the photographs. Two of his pictures showed flashes exactly duplicated, each flash striking a different track of the railway near a road crossing—which was about 150 feet away from the camera. I doubt whether any lightning flashes have been caught at such close range or if observers generally would be content with that distance. But Mr. Sprange was unaware of the proximity until I pointed out the fact.

Curiously, also the flashes in this case were found by me upon investigation to have leaped between an electric light wire about 25 feet above the track, said wire running along the road on poles transversely to the track, being an arc light line fed from the Lynn Station, about five miles away. The hot gas streak with all its curlings and twistings as formed by a flash to one of the tracks from the electric light line had been laterally transferred by the wind and when it was directly over the steel rail of the other track, another flash took place repeating in minute detail the first flash. Not only this, but from the fact that Mr. Sprange was able to catch this phenomenon twice, one cannot escape the conclusion that it probably occurred repeatedly during the storm. Furthermore, the fact of the hot streak arriving over the second track must evidently have been the determining cause of the actual formation of the duplicate flash, since by its conductivity the track was for the moment connected to the overhead wire, thus giving rise to an easy earth for lightning striking the electric light wire somewhere else.

In Dr. Kennelly's very full and interesting account of a multiple flash, given on page 651 of your issue of Oct. 28, I notice that he endeavors to arrive at the distance of the flash by the time it took for the thunder to reach the observer. As I have already pointed out elsewhere, such estimations are very uncertain. In my own experience, in cases of lightning stroke I have generally found the estimate of distance so obtained too low.

The explanation is that the first sound reaching the observer comes from that part of the flash nearest to him. This may be given by one of the branches of the discharge nearly overhead. The heavy explosion, often noted in thunder preceded by a rolling noise and ending with a similar distant sound, probably indicates the "trunk flash" between cloud and earth, and should be used in counting time. Even then there is no certainty that some part of the spark or flash nearer the observer may not give the louder explosive noise. The order view that the rolling noises in thunder are due to reverberations, it will be seen, is here regarded as of very secondary importance.

For many years I have regarded the succession of noises which we call thunder as an indication of the relation of the spark or flash to the observer, the various sounds succeeding each other from the more and more distant portions of the path. This is, doubtless, the true view.

Grounding of Low-Tension Circuits.

BY W. L. R. EMMET.

The article by W. B. and L. C. Reed, in the ELECTRICAL WORLD AND ENGINEER of Oct. 28, raises certain objections to the grounding of low-tension distributing systems, operating either from generators or from the secondaries of transformers. Certain cases are cited where dangerous potentials might exist on the secondary circuits when a high-tension current with large volume was being discharged to ground through these circuits, or through their ground connections.

In the examples explained, the dangerous differences of potential are supposed to arise from the existence of a high resistance between the low-tension system and ground, or between the two sides of the low-tension system; it being assumed that the volume of the high-tension current discharged is sufficient to cause a large drop of potential at these points. If the assumed conditions existed, the results described would, of course, be realized. In practice, however, the assumed conditions would very seldom exist.

In the paper read by the writer at the last meeting of the National Electric Light Association, the principles involved were briefly explained, although no attempt was made to fully specify all the precautions which must be taken, or all sources of danger which should be considered. The whole subject is now being carefully studied by representatives of the American Institute of Electrical Engineers and of the Nationad Board of Fire Underwriters, and the result of this investigation will lead to the adoption of new standards, which will be of great advantage to the public, as well as to the electrical industry.

Low-tension distributing circuits for house service may be generally divided into two classes; those where the house wiring is connected to a system of mains in the street, and those where the house wiring is led from a transformer without any low-tension system of street wiring. In the first case there is danger of contact between the system of low-tension street wiring and any system of high-tension wiring which may occupy the same street. In the second case, there is ordinarily only one chance of contact between the system of low-tension wiring and any high-tension system; namely, the possibility of a cross between primary and secondary in the transformer. In order that the dangerous conditions predicted by the Messrs. Reed may be realized, it is necessary that the high-potential circuit, with which the lighting circuit is accidentally crossed, shall give current enough to cause an appreciable drop in the wiring of apparatus connected to the low-tension system, or in the connections between the low-tension system and the ground.

Let us first consider the possibility of this condition with circuits where house wiring is supplied from low-tension mains in the street. In such a case, these low-tension mains receive current either from the secondaries of one or more large transformers, or from the armatures of one or more generators. The resistance of transformer secondaries and dynamo armatures are ordinarily such that the full load current which they supply does not cause a drop of potential in the armature or secondary greater than 2 per cent. of the normal voltage. Consequently, in order that the drop in potential across the terminals of such apparatus may give rise to dangerous potential differences, it is necessary that a current be received from the high-tension source, which is many times the normal full load low-tension current. In practice, a current which would cause such dangerous drop in windings of apparatus, would instantly burn off the conductors through which the cross occurs. In fact, there is no conductor connected with an ordinary low-tension system of wiring, which would carry a current sufficient to cause such potential distributions as the writers of this article

predict. In grounding low-tension distributing system, connections of such low resistance should be used, that no appreciable drop would occur when they are called upon to carry heavy currents. If the ground connection is of insufficient carrying capacity, or of such high resistance as to give rise to the conditions predicted in this article, it would, of course, not be a reliable source of protection. The character and number of these ground connections should, of course, be governed by carefully drawn rules.

The most fruitful source of failure of ground connections as protective devices would lie in the possibility of blowing low-tension fuses by current received from high-tension systems. Such blowing of fuses might, of course, give rise to high-potential differences between the different conductors of low-tension wiring systems, which might cause fires in buildings. The danger from this source is, however, less serious than we might at first suppose, since it is generally easy so to arrange circuits that there is no possibility of crosses which could deliver enough current to blow the secondary fuses. Where houses are operated from single transformers, a cross between primary and secondary in transformer will blow the primary fuses, if the secondary is grounded, and any condition exists by which there is a tendency to discharge primary current into the secondary circuit. Current delivered from the primary to the secondary system in such a case would flow directly through both fuses, and would naturally blow primary fuses first, since they are of smaller capacity.

In the case of low-tension street-wiring systems, a large network is generally used which distributes a large amount of power. Thus the aggregate current capacity of all the fuses supplying such a low-tension system is generally large, and it would ordinarily be impossible to get a cross with any high-voltage system which could deliver current enough to cause all these fuses to blow. The possibility of this danger should, however, always be kept in view, when a low-tension distributing system is being installed.

The writers of the article above mentioned suggest the installation of automatic circuit-opening devices in the service connections of each house; these devices to be actuated by any high-potential differences which may exist on the house wiring. Such devices, if properly constructed, would unquestionably reduce the risk of trouble in case other precautions failed. They could, however, not be relied upon as an absolute source of protection. The reason for this is that such devices must require a certain amount of time to act, and that during this period the damage may be done. The first impulse of high pressure received on the low-tension system may break down its insulation, and by doing so, stops the potential difference which would cause the automatic device to act. These devices are, therefore, open to the same objections which apply to the various automatic grounding devices which have been proposed and used as substitutes for permanent ground connections. Such grounding devices have been used to a considerable extent in Europe, and are approved by some of the codes of rules there in force. They cannot, however, take the place of the permanent ground connection, and it is not probable that any adequate substitute will be discovered.

Frequency Meters.

BY PROF. REGINALD A. FESSENDEN.

A CONSIDERABLE number of devices for use as frequency meters have recently been described, most of them giving the periodicity by the measurement of a vibration. These meters have, however, the great disadvantage that they only read accurately over a small range and must, moreover, be adjusted to a zero before taking a reading, so that they are incapable of measuring small fluctuations in the frequency, such as are caused, for instance, by bolt joint passing over a pulley.

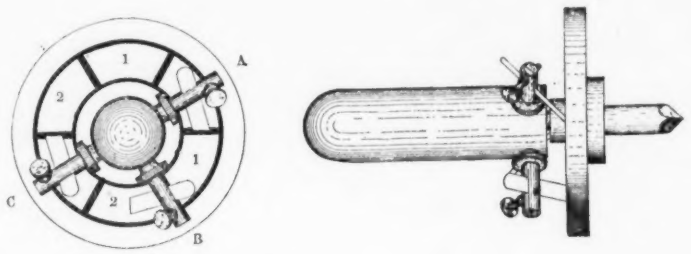
In a recent editorial in the ELECTRICAL WORLD AND ENGINEER the following statement is made:

"If, however, a simple frequency meter with an indicating needle or other device reading on a scale of cycles per second could be devised, it would probably be much more popular than the tachometer, as it would permit the speed to be indicated by an instrument upon the switchboard and directly under the eye of the attendant. The prospects of a practical instrument of this type would appear to be slight."

From this it is evident that others have felt the want of such an instrument as well as myself, but have not been equally fortunate in supplying it. In reality, it is indispensable, though many experimenters do not appreciate this. I was recently shown a set of voltage curves taken from an alternating current dynamo by a very ingenious apparatus. The curves were stated to be accurate to within one-tenth of one per cent. I asked my informant how the dynamo was driven. In reply I was told, "by an engine in the ordinary way." I did not feel called upon to be so impolite as to doubt the wonderful accuracy of the curves taken under these circumstances, but I could not help wishing that I had an engine which regulated to within one-tenth of one per cent., as I would thus be enabled to save much time now wasted in correcting for fluctuations in speed. In reality it is nonsense to speak of taking alternating current curves correct to within one per cent. unless the dynamo is driven (as my own experimental one is) by a storage battery, or there is some way of knowing accurately what the periodicity really is.

I said that the problem of obtaining such a tachometer had been solved. The instrument will be found described under the title of "Some New Electrical Apparatus," in the ELECTRICAL WORLD, of December 5, 1896, page 688. Referring to the accompanying cut, one of the little brushes is connected to a storage battery, one to a condenser and one to a specially dampened Weston voltmeter, though sometimes a ballistic galvanometer is used. The other terminals of the storage battery, condenser and voltmeter are connected together.

The standardizing can be done absolutely, but I prefer to put an ordinary speed indicator at the opposite end of the shaft from that to which the tachometer is connected, and by taking a five-minute reading, standardize it that way. Then, if the voltage of the storage cell has lowered, I throw out a little of the non-inductive resistance in series with the voltmeter coil, till when the periodicity



FREQUENCY METER.

is 100, the voltmeter reads 100 on the scale. As very little current is used, this resistance need not be altered for a week at a time, especially if the precaution be taken of running a little current off from the cell directly after charging.

In operating, when taking alternating current curves, I leave the tachometer in the engine room, running the wires to the voltmeter, etc., in the laboratory, the Weston voltmeter or galvanometer, suitably shielded, being right alongside the instruments used. Thus every fluctuation due to the passage of the belt splice over the pulley can be seen, or even, when the machine is heavily loaded, the change of speed of the engine during its stroke, and one can be sure of getting accurate results.

By attaching it to a small synchronous motor I have used it to tell frequencies at any place on a line, when it is not convenient to have some one at the station on account of its being a distance away from the point where the work is being done.

In view of the fact that this instrument gives an open and proportional scale reading from 1 to 1500, that it is absolutely accurate, being, in fact, the only accurate tachometer with wide range ever made, that its reading can be relied upon to 1-5 of 1 per cent. if the dividing on the Weston instrument is checked by a potentiometer wire, and that it will show fluctuations of 1-20 per cent., I believe that the above description will be of interest to the large number of workers who, as is apparent from the number of papers recently published on the subject, are in need of such a device. I might mention in addition two other great advantages, i. e., that the readings may be made at any distance from the rotating part, and that the friction is so small that the application of the tachometer doesn't slow down the apparatus whose speed of revolution is being measured.

Marconi Wireless Telegraph Patents.*

Since the date of the original English Marconi patent (No. 12,039, of 1896), Mr. Marconi has applied for eight patents for improvements in apparatus for wireless telegraphy. The substance of the first three is given below. For a fourth a provisional specification only was filed, and a complete specification was not left at the patent office within the allotted nine months, so that the provisional protection has now lapsed, and no publication of the patent has been made. The remaining four of these patents are still in their provisional stage.

The fundamental patent referred to above, which was applied for on June 2, 1896, described the combinations of a Hertz-Righi oscillator, Branly tube, electromagnetic tapper, capacities, and inductive and non-inductive resistances, employed by Mr. Marconi in his original experiments.

The next patent, No. 29,306, of 1897, was applied for on Dec. 10, 1897, the complete specification being filed on Sept. 12, 1898, and accepted on Oct. 15 of that year. It was originally in the name of Marconi, but was subsequently amended to include that of the Wireless Telegraph & Signal Company. In the patent Mr. Marconi describes how he encloses the receiver, containing the sensitive tube, in a box of thick metal with a small opening. The object of this is to avoid injury to the tube by its close proximity to the sparking appliance. The obvious employment of the same (vertical) conductor and earth plate both for the transmitting and receiving apparatus is specified, with a switch for connecting these to either instrument. An arrangement of the apparatus and box is described with reference to a drawing. Two small apertures in the box are necessary for contact to be made by the switch to the terminals of the sensitive tube. It is explained that, if these apertures are kept within a certain distance, "say, 15 inches from and out of the line of the sparking appliance," it will not be necessary to close them, but a method is described of connecting the switch lever to two shutters by means of a cord passing over pulleys, so that the apertures are closed as the lever is turned over to the transmitting position. Sheet iron of one-sixteenth of an inch in thickness is deemed suitable for the walls of the box. The description is followed by a disclaimer as follows:

"Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we are aware that it has previously been proposed, in a system of wireless telegraphy, (1) to protect the receiver from the effect of the local transmitter by enclosing it in a metallic box, (2) to use the same conducting surface or surfaces for both instruments, (3) to connect and disconnect the two instruments by means of a change-over switch, and (4) to open and close apertures in the metallic box containing the receiver by means operated by the switch lever, and we wish it to be generally understood that we make no general claim to such arrangement or combination of apparatus."

The first claim is:

"In apparatus comprising a transmitter, a receiver, a conducting surface, and a switch, providing an automatic shutter which closes the box when the transmitter is being used."

The second claim is in the usual form for "apparatus substantially as described and illustrated in the drawings."

On June 1, 1898, two patents, 12,325 and 12,326, were filed.† The complete specification for the former was left on March 1 last and accepted on May 7. It relates again to the enclosure of the receiving apparatus in its iron box. When a recording instrument is employed, wires to it must enter the box, and, in order to prevent injurious oscillations being led by them to the sensitive tube, the following arrangements are adopted: One connection is made by the metal of the box itself (the specified suitable thickness of the box has, by the way, now been diminished to 1-20 inch). The second connection is made by a coil of insulated wire covered with tinfoil or other metallic conductor. The coil is outside the box, its end passing through the metal. The coil may or may not be protected from injury by a small metallic case. The metal foil is connected to the metal of the box. It is suggested that the coil may contain 20 yards of wire 1-75 inch in diameter, and have 120 turns. Wire insulated with gutta percha is employed.

The complete specification of patent No. 12,326, of June 1, 1898, was left on April 4 last, and accepted on July 1. Both this one and No. 12,325 are in the names of G. Marconi and the Wireless Telegraph & Signal Company. This patent appears to be of considerable importance. It refers to the receiving apparatus—"in

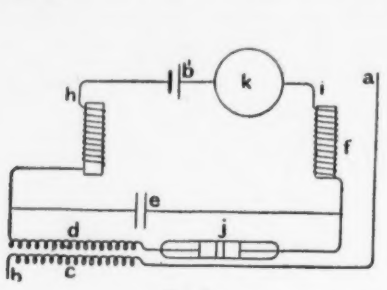


FIG. 1.

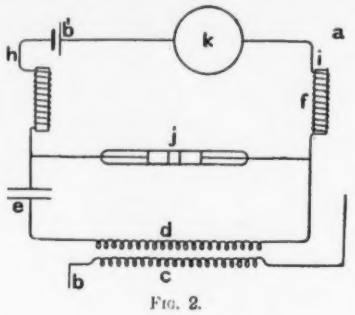


FIG. 2.

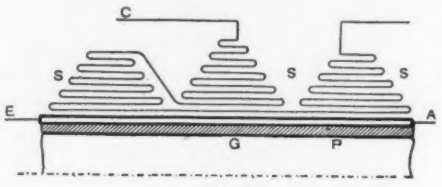


FIG. 3.

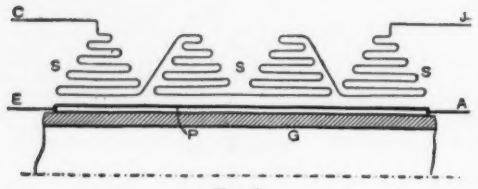


FIG. 4.

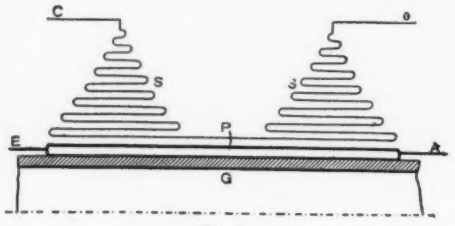


FIG. 5.

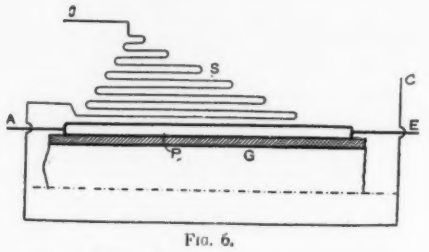


FIG. 6.

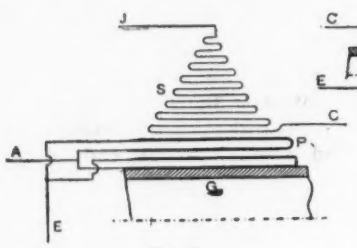


FIG. 7.

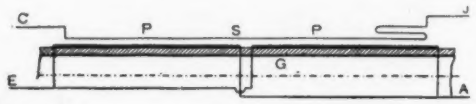


FIG. 8.

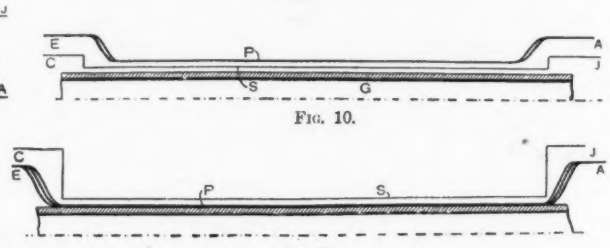


FIG. 10.

FIG. 9.

FIGS. 1 TO 10.—MARCONI WIRELESS TELEGRAPH PATENTS.

*From the London *Electrician*.

†These two patents appear to correspond with the following United States patents: No. 624,516, May 9, 1899, abstracted on page 655 of our issue of May 20, 1899; and No. 627,650, June 27, 1899, abstracted on page 119, July 22, 1899.

which the ends of an imperfect conductor in a local circuit were connected, one to earth, and the other to an insulated conductor,"—described in the fundamental 1896 patent, and states that, according to the present invention, the conductor is connected to earth or to a suitable capacity through the primary of an induction coil or transformer, whilst the ends of the "imperfect contact" are connected to the ends of the secondary, one of the connections passing through a condenser. The complete specification continues:

"The effect of electrical oscillations on the imperfect contact seems to increase very greatly with their e. m. f., and not with their quantity. The object of this invention is to increase the e. m. f. of the received oscillations by transforming up their e. m. f. at the expense of the quantity. This greatly increases the distance over which at parity of other conditions it is possible to transmit and receive messages.

"It is found that if the induction coil or transformer is wound with the ordinary wire used for bobbins or induction coils it fails to work, and its adoption would, instead of improving, greatly reduce the effectiveness of the apparatus, and when the induction coil is wound with very thin wire it only then becomes effective provided it is wound on a nucleus of suitable diameter. The number of turns of each winding and the number of layers must also be carefully determined. If the coil is much longer than 2-cm it is found that unless the secondary is wound in several sections the two windings must be each in one single layer, but if the coil is less than 1-cm long it is advantageous that the primary and secondary windings should be in several layers. It has also been noticed that it is an advantage if the number of turns is diminished in each layer as the distance from the primary increases.

"The introduction of this induction coil not only improves the signals, but also prevents to a great extent any interference which might be caused by electrical atmospheric influences."

Fig. 1 is a diagram of the arrangement preferred. Fig. 2 shows a modification. Figs. 3 to 10 are diagrams of various forms of induction coil.

In Fig. 1, *a* is the long conductor suspended in the air by insulators, and *b* is the usual connection to earth or to a capacity. b^1 is the local battery, and *k* is the relay working the telegraph instrument, the arrangements being similar to those described in the 1896 specification. *c* is the primary of the induction coil or transformer, and *d* is the secondary. *e* is a condenser placed across the "sensitive imperfect contact" and the secondary winding. "*f f* are choking coils, their object being to prevent the oscillations generated in the winding *d* from running into the battery connections at *h* and *i*, which would weaken the effect of the oscillations on the sensitive imperfect contact *j*." Fig. 2 shows an alternative arrangement which, it is stated, does not give quite such good results as Fig. 1.

The specification does not pmit to give dimensions as a guide to the constructor of the apparatus:

"One plate of the condenser consists of three plates of copper foil 3:75 x 2.5-cm. The other consists of two plates of the same dimensions separated by paraffine paper 0.015-cm in thickness.

"When using the above-described induction coil or transformer there is usually employed as the vertical wire at each station a conductor formed of seven strands of about 1-mm diameter copper wire 140 feet long, the top of the conductor being about 100 feet from the ground.

"In some cases, in lieu of the above-described conductor, a galvanized iron netting about 2 feet broad and 130 feet long, may be employed, the top of the netting being about 110 feet above the ground.

"In Figs. 3 to 10, *P* is the primary and *S* the secondary of the induction coil. To distinguish it from the secondary, the primary is shown as a thick line, although usually the wires of both are of exactly the same diameter. The diagrams are greatly enlarged half longitudinal sections, but are not strictly to scale. "In place also of showing the section of each coil or layer of wire as a longitudinal row of dots or small circles as it would actually appear, it is for simplicity shown as a single continuous longitudinal straight line." *A* is the end of the primary which is connected to the aerial conductor *a*, and *E* is the end connected to earth or a capacity. *J* is the end of the secondary which is directly connected to the "sensitive tube or imperfect contact" *j*, and *C* is the end connected to it through the condenser. *G* is a glass tube on which the coils are wound. The wires are insulated by a single covering of silk."

The accompanying table from the specification gives particulars of coils which have been successfully employed.

It is stated that the arrangement shown in Fig. 3 gives the best results. "It is found desirable to connect direct to the tube (not through the condenser) the end of the secondary which is furthest away from the nucleus." The condenser *e* may be omitted, but in that case the results obtained are far less satisfactory. It is repeated that a capacity may be substituted for, or introduced into, the earth connection.

An attempt is made to avoid invalidating or injuring a subsequent patent, by the following sentence: "The special induction coils shown at Figs. 3 to 8 form the subject of another application, No. 6982, dated April 1, 1899, and are not claimed per se in this specifiation." No. 6892 of 1899 is one of the patents referred to above as still being in their provisional stage. The complete specification need not be filed until Jan. 1, 1900, and, if accepted, publication will only take place some weeks after this latter date.

The following are the claims of patent 12,326 of 1898:

1. Connecting the conductor to earth through the primary of an induction coil or transformer, and connecting the ends of the

DATA OF MARCONI COILS.

Fig. in Drawings	Diameter of Tube G in Cm.	Diameter of Wires in Centimeters.		Resistance in Ohms.		Number of Turns in Windings.		Length in Centimeters.
		Primary.	Secondary.	Primary.	Secondary.	Primary.	Secondary.	
Fig. 3.	0.935	0.01	0.01			Two layers of 160 turns each in parallel.	Three sections of 10, 12, 10 layers with 45 40 35 30 25 20 15 12 5 / 150 / 40 39 37 35 33 29 25 21 15 10 5 / 45 40 35 30 25 20 15 17 14 turns.	2.5
Fig. 4.	0.937	0 012	0.012			Two layers of 160 turns each in parallel.	Four sections of 9 layers each with 40 35 30 27 23 20 15 10 5 / 35 30 27 23 20 15 10 5 / 80 / 35 30 27 23 20 15 10 5 / 40 35 30 27 23 20 15 10 5 turns.	4.0
Fig. 5.	0.937	0.011	0.011	4.8	61	Two layers of 160 turns each in parallel.	Two sections of 15 layers each with 60 50 40 35 33 30 27 24 23 17 15 10 6 2 / 153 / 63 50 40 35 33 30 27 24 22 18 15 10 6 2 turns.	2.5
Fig. 6.	0.975	0 012	0.012			Two layers of 110 each in parallel.	Twelve layers of 100 80 75 60 50 45 40 28 20 15 10 5 turns.	1.8
Fig. 7.	0.975	0.012	0.012			4 layers. 80 turns, 78 " } in series. 76 turns, 72 " } in series.	Sixteen layers of 60 54 46 42 40 36 32 29 26 23 20 18 14 12 9 7 turns.	1.5
Fig. 8.	0.975	0.012	0.012	5.75	28.5	One layer of two wires in parallel with 160 turns each wound tandem.	Three layers of 310, 45, 45 turns.	.8
Fig. 9.	0.975	0.012	0.012	3.2	30	One layer of three wires in parallel with 160 turns each	One layer of 500 turns.	7.8
Fig. 9	0.935	0.012	0.012	2.8	23	One layer of three wires in parallel with 140 turns each.	One layer of 420 turns.	8.1
Fig. 10.	0.93	0.012	0.012	4.9	22	One layer of two wires in parallel with 160 turns each.	One layer of 400 turns.	7.8
Fig. 10.	0.7	0.012	0.005	3.75	100	One layer of two wires in parallel with 170 turns each.	One layer of 680 turns.	7.48

imperfect contact to the ends of the secondary, one of the connections being through a condenser.

2. Connecting the conductor to earth through the primary of an induction coil or transformer, and the ends of the imperfect contact to the ends of the secondary, and also to choking coils, the other ends of which are connected to the local circuit.

3. Connecting the conductor to earth through the primary of an induction coil or transformer and the ends of the imperfect contact to the ends of the secondary, both the primary and secondary being of wire and exceeding one-fortieth of a centimeter in diameter.

4. Connecting the conductor to earth through the primary of an induction coil or transformer and the ends of the imperfect contact to the ends of the secondary, both the primary and secondary being wound in a single layer.

5. In apparatus such as is referred to in the preceding claims, substituting a capacity for the earth.

6. Apparatus substantially as described and illustrated in Figs. 1 and 2 of the drawings.

7. Induction coils substantially as described and illustrated in Figs. 9 and 10 of the drawings.

The idea of an induction coil, the primary of which is connected between the receiving wire and earth, and the secondary to the receiving circuit, seems, however, to have been embodied by Prof. O. J. Lodge in his patent, No. 11,575 of 1897 (May 10). After describing various resonators or receivers in which an inductance is included in the circuit for syntonizing purposes, he says:

"In some cases I may . . . . surround the syntonizing coil of the resonator with another secondary coil (constituting a species of transformer) and make this latter coil part of the coherer circuit, so that it shall be secondarily affected by the alternating currents excited in the conductor of the resonator, and thus the coherer be stimulated by the current in this secondary coil rather than primarily by the currents in the syntonizing coil itself; the idea being thus to leave the resonator freer to vibrate electrically without disturbance from attached wires."

This is illustrated by a diagram. The ninth claim of this patent of Dr. Lodge's reads thus:

"In a system of syntonic Hertzian wave telegraphy the combination with the self-inductance coil of the receiver of a secondary coil surrounding the same, which secondary coil forms part of the coherer circuit substantially as and for the purpose set forth."

Double Voltage and Current Generators.

BY ALTON D. ADAMS.

The army of electrical engineers is rapidly thinning the heterogeneous generating equipments in modern electric stations. The first great advance lay in the adoption of a uniform character for the main dynamos. The second movement gave each machine capacity to deliver either direct or alternating current, as illustrated in recent equipment for the Chicago Edison Company. A third and final improvement in this line, and one that must soon find application from its great utility, is the combination of double voltage with direct and alternating current supply from each generating unit.

A uniform character for main dynamos that deliver but one kind of current at a single pressure tends to reduced steam consumption and to fuel economy, but multiplies as much as three or four times, in some cases, the necessary total capacity of electrical machinery in the station, or between the engines and the consuming devices of customers. For an average case, if the electric energy is first generated as alternating current, a part must be converted to the direct; if direct at first, then a part to alternating. If the main alternating current is generated at comparatively high pressure, say 2000 or 3000 volts, the conversion to direct current requires transformers and rotary converters, making the total machine capacity three times the actual output to customers. If all current from the main generators is low pressure, direct for the three-wire system, then the change to high-pressure alternating current for use at a distance again requires rotary converters and transformers, and the machine equipment is three times the maximum rate of output.

From the above considerations is follows that generators that are able to deliver their output as either direct or alternating current or a part in each, at a low voltage, are at an obvious advantage, because direct current from them is at once available for use in the three-wire service without passing through any auxiliary machinery. The alternating current from these direct-alternating generators, however, being at low pressure, is not suitable for service at a distance, and must be raised in pressure by the use of suitable transformers, as at the Chicago plant, above mentioned. In this case the station capacity in alternating current apparatus is, therefore, twice the possible output. It is improbable that direct-alternating generators will be built of pressures high enough for service at any considerable distance with alternating currents, since pressures of 2,000 or 3,000 volts at the direct-current side of the machine would add materially to their construction costs, and to the difficulties of operation at commutators. Should the high-pressure construction be adopted in any case with double-current generators, the direct current must pass through dynamotors to fit it for the low pressure, three-wire service and the station machinery will thus have more than double the output capacity for direct currents. In this case the high pressure alternating current obviously requires no further station equipment.

It is thus evident that, while with single-current generators both the pressure and quality of current must be changed for a part of the output, with double-current generators a change is necessary only as to current pressure, thus saving a capacity of machine equipment at stations equal to the output in one kind of current. If now means can be found by which both direct and alternating currents can be generated by every dynamo, each current being delivered at the pressure desired for its purpose, the necessity for auxiliary apparatus in the way of transformers, rotary converters and dynamotors at the main station will be avoided, and the output correspond in capacity with the machinery in operation at any one time.

In addition to the great saving in machinery investment and station space, the double voltage and current generators will make available the full economy of better operated conditions in steam cylinders, which economy seems likely to be largely offset, in some cases, by the large amount of auxiliary machinery operated from single-current generators. The double voltage and current generators must have at least two independent armature windings, each winding being designed for the desired volt and ampere capacity. One or more sets of windings, usually that for high pressure, will be connected to the proper contact rings and deliver single, two or three-phase alternating currents. The other set of windings, connected to a commutator, will furnish direct current, mostly at low pressure, for the three-wire system.

In cases where low pressure alternating current is preferred to the direct in the nearby mains, the low pressure windings may terminate in separate contact rings and deliver either one, two or three-phase currents. In the majority of cases, however, there will be a preference for direct current in the low-pressure supply because of the smaller first cost and more ready contact of motors on this system, and the possible use of batteries in connection with it.

At first thought it may seem that two independent sets of windings on the same armature, one delivering direct and the other alternating current, will lead to serious complication, but such is not the case, as may be seen from the fact that the effective single-phase windings of an alternator occupy less than one-half the armature space. The space not required by winding of one phase may be filled either by windings for one or more other phases of alternating current, or by those for direct current. If single-phase alternating current is generated in one set of windings, an equal output may be obtained from additional windings for direct current, without reducing the supply on the alternating side. If alternating current is wanted on both the high and low pressure sides of single phase, each winding will have as much output as though the other did not exist.

The great advantages of a storage battery auxiliary can be fully realized with the double-voltage and current generators, to increase direct-current capacity at times of maximum load, to supply the entire output of both direct and alternating current at times of minimum load, and to regulate the station pressures for both the direct and alternating currents at any load. The battery, operated in multiple with the direct-current windings, acts to maintain the direct-current pressure in the usual way, and also tends to maintain the pressure in the alternating-current coils, because any momentary increase in the load of these coils, tending to lower their pressure by slowing up the armature and reacting on the magnetic field, lowers through these same means the pressure and, consequently, the current in the direct coils, thus reducing the total armature reaction and the engine load.

The battery in this last case assumes a momentary load to compensate for the increased output of the alternating coils with which

it has no electrical connection. If the generators can be detached from the engines, or if it is thought desirable to let an engine run without steam at times of light load, the battery will not only care for the direct-current output in the usual way, but will also supply the high-pressure alternating current by the use of a generator as a dynamotor, taking battery current in its direct windings to drive it while alternating current is generated in the other windings.

Double-voltage and current generators may be said to insure for the average station conditions the lowest first cost, the greatest operative economy, and the largest degree of reliability and flexibility in use.

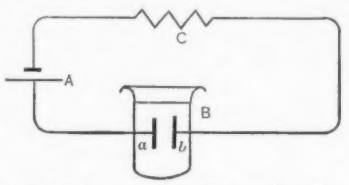
Platinum Electrolytic Cell.

At the recent meeting of the American Physical Society, Prof. M. I. Pupin read a paper entitled, "Unipolar Conductor," describing an arrangement for rectifying alternating currents. In the accompanying illustration, *A* is a galvanic cell, *B* an electrolytic cell, say of two platinum plates, *a b*, in acidulated water.

Let the e. m. f. of *A* be equal to the decomposition value of the electrolyte in *B*, then no steady current will pass in the circuit *A B C*. The circuit thus balanced the author called a unipolar conductor, as an e. m. f. applied to this circuit will produce a current if it acts in the direction of the e. m. f. of *A* and it will produce no current if it acts in the opposite direction.

The arrangement can be employed as a rectifier of alternating currents, as follows:

Let an alternating e. m. f. be impressed upon the circuit *A B C*. This circuit has ohmic resistance, self-inductance, and capacity owing to the capacity effect of the plates *a b*. But the electrolytic cell acts as a condenser only until the difference of potential of the plates *a b* is smaller than the decomposition value of the electrolyte. When this value is passed, the circuit will have resistance reaction, said self-induction reaction only, and the circuit becomes a true conduction current. Hence, if by making the plates *a b* small enough we make the capacity reactance large in comparison to the other two reactions, the conduction current will be large in comparison to the capacity current; so that if in this case the amplitude of the alternating e. m. f. is approximately equal to twice the e. m. f. of *A*, we get a rectification of the alternating current. If the area of one of the electrodes of *B* is 1 mm², the rectification is very efficient up to 1000 p. p. s. For higher frequencies smaller electrodes are necessary. The electrode best adapted for an electrolytic cell of this kind consists of a glass tube in which a platinum wire is sealed and polished off at the terminal.



ALTERNATING CURRENT RECTIFIER.

The electrolyte employed was acidulated water. The author succeeded in rectifying electric oscillations of the Hertzian frequencies, demonstrating that even at these frequencies electrolytic decomposition takes place. In these experiments the wire sealed in the glass had to be .001 inch thick.

Use of Marconi Wireless in America.

There seems to be a little difference of official opinion as to the use of the Marconi wireless telegraph system by the government. Lieutenant Commander John T. Newton, Lieutenant Hill and Lieutenant John B. Blish, of the navy, the three officers who had charge of the recent experiments in the utilization of the system at sea, have submitted their report to Washington. It is said to be favorable to the adoption of the system by the government. General Greely, chief signal officer, said last week, however, that there would be no practical demonstration of the Marconi system of wireless telegraphy in connection with the signal service of the army. It is understood that the instruments brought by Marconi to this country are unsuited to greater distances than 12 miles by land or 30 miles by water. The signal corps, which operates a system of its own at a distance of 12 miles, was unwilling to have demonstrations made unless there could be assurances of greater distances than those promised.

Mr. Marconi is to sail at once for England, where, it is said, the British government requires his services in connection with the South African campaign.

Report of the Chief Signal Officer.

The extent to which the government is constructing and operating cable and telegraph lines as a result of recent territorial acquisitions and controls is brought out in the report of General Greely, chief signal office. This shows that the telegraph system of Cuba, formerly owned and operated by Spain, has been taken over and developed by the signal corps, and that at the close of the fiscal year 2500 miles of line were in operation, of which 606 miles were absolutely new lines and the remainder largely reconstructed.

General Greely discusses the question of Cuban cable and telephone concessions, showing the legal and diplomatic difficulties surrounding them, as well as the practical difficulties under which the military cable lines are kept in operation. He recommends the laying of a deep-sea cable between Puerto Rico and Cuba, which would cost about $600,000. By this means all communication between Puerto Rico and the United States would pass over strictly American lines.

In the Philippines General Greely shows that the effort of the United States to lay cables for military operations was antagonized by private companies owning lines there. He says there are certain provisions of the Spanish cable concessions which plainly cannot be acceded to by the United States, especially the absolute cable rights for an indefinite period, not only in the Philippines, but in all Spanish possessions in the Pacific. He says it is only a matter of time when Luzon will be connected with Formosa by an international cable, thus giving an outlet to Japan and China.

A vague idea of the magnitude of the signal corps' work under Major Thompson's supervision in the Philippines, he says, may be conveyed by the statement that over the telegraph system alone more than 260,000 messages, many long and all on public business, were transmitted in the ten months ending June 30, and over 45,000 in May alone.

As to a Pacific cable the report says in part: "In order to join close together the United States and its Pacific colonies it is essential to span the Pacific by a submarine cable, as recommended by the president to congress in his special message of Feb. 10, 1899. The great value of such a cable is not alone for military purposes, but more especially for the fostering of industrial interests in the new colonies and in order to facilitate commercial operations." General Greely suggests that an international cable conference should consider the whole subject of the rights of cable property in time of war.

Wireless telegraphy receives considerable attention. General Greely says that as a means of connecting the islands of the West Indies, Hawaii and the Philippines, which are in the range of its action, wireless telegraphy should prove of value. The signal corps' experiments have shown that its officers and men are able to furnish a practicable system of wireless telegraphy. The signal corps has already operated its own system successfully between Fire Island and Fire Island Lightship, a distance of about 12 miles. General Greely says there is no reasonable doubt that in the immediate future wireless telegraphy will replace, with equal advantage to commerce and the army, the military cables necessary to connect harbor fortifications.

Giving News by Telephone in New England.

President Morris F. Tyler, of the Southern New England Telephone Company, is pushing a project to station an extra operator at all the large exchanges to give subscribers the latest news. A representative of the New York Stock Quotation Company, which operates the "tickers" of New York City and furnishes news to the outside ticker companies throughout the country, says: "In the first place this system could never take the place of a ticker in the saloons and hotels, where most of our instruments are located. Anybody can watch a tape, but news sent in by telephone would have to be copied down for the crowd to read, and very few proprietors would care to take the trouble, even if they saved money by it. In the second place, they wouldn't save money. A ticker costs just $20 a month. You can get a telephone for less, if you don't use it much, but if you spend your time calling up central to ask for news, your bill would run up into the thirties mighty quick." The proposed system is somewhat similar to that adopted at Budapest.

The Wireless Telegraph Tests in the U. S. Navy.

The practical tests of the Marconi system of wireless telegraphy, which have been conducted during the past two weeks on United States warships, and which tests were referred to in these columns last week, were concluded on Nov. 1. At the Highlands of the Navesink a station was established, and placed in charge of Lieut. Blish, for the purpose of interrupting messages sent between the New York and Massachusetts. The interference apparatus on the Highlands consisted of a 150-foot vertical wire triced up on a pole. To the foot of this wire a Marconi instrument was attached so that when a message was sent from the Navesink station it would interrupt any messages being sent at the same time within the radial circumferences of the electrical wave produced by the sending of the message. The two warships left their anchorage off West Thirty-fifth Street on Monday forenoon and went down the bay, where the tests were begun. On the way messages were exchanged successfully and to the expressed satisfaction of the commission. When the warships arrived off Navesink the New York anchored and the Massachusetts steamed out to sea thirty-six miles for the purpose of making long-distance tests and also to try the extent of the interference the apparatus at Navesink would exercise while messages were being exchanged btween the warships. All the time the Massachusetts was making her way to sea messages were exchanged between her and the New York at intervals of ten minutes, and interference messages were sent by the operator at Navesink at longer intervals. The interference messages were successful and rendered the messages between the warships unintelligible. At a distance of thirty-six miles the messages sent by the New York to the Massachusetts failed to carry, and the battleship came back and anchored a few hundred yards from the New York. During the day forty-five messages were sent by the New York. Of these twenty-three were received and five were interrupted. The storm that came up on Monday night disabled the wireless telegraphy apparatus, and on Tuesday afternoon the New York and Massachusetts were compelled by the rought weather to come inside Sandy Hook. While going out to sea Wednesday morning a man fell overboard from the Massachusetts and the news was telegraphed wirelessly to the New York ten minutes before it could be wigwagged by the signal man. The man was rescued by a cutter. The tests were continued all day and were pronounced satisfactory. Before beginning the experiments Mr. Marconi wrote to the commission, explaining that he had not received sufficient notice to enable him to get his instruments in shape. He added that he had an instrument which would render interference practically impossible.

Division of a Five-Cent Fare.

At the Fiftieth Street power house, New York City, on the evening of Nov. 4, at the first meeting of the Metropolitan Street Railway Association since the threatened strike, President Vreeland delivered an address to his men concerning management and operation. "To the minds of people like us," said he, "engaged in a business the financial foundation of which is a five-cent piece, the mention of millions of dollars really conveys only a dim idea. There is a certain point at which the mind loses grasp of the significance of figures; it is like talking of the vast interstellar spaces. We know they are very great and we let it go at that. When it comes to 5 cents, though, that is right in our line, and in order to bring within the understanding of every one just how each five-cent piece you men collect is divided, I have made the following analysis from the company's records to show where we stand with the capitalists who own the property we operate. You will observe they do not get much the best of us on the divide, for this is how the nickel is distributed:

Labor	.0195
Material	.0048½
Taxes	.0026½
Interest	.0144
Total	.0414
Leaving for stockholders	.0086
Total	.0500

"The fact that less than seven-eighths of 1 cent out of every fare goes to the owners—in other words, the stockholders of the property—will, I doubt not, be interesting to a great many public instructors, who continually discuss the railroad business as one where there is nothing but income to embarrass the management. Another interesting fact was developed in this investigation of mine, and that was that out of every dollar spent in operating the Metropolitan system, 80 cents went for wages, and only 20 cents for material."

Repressing Trolley Development in Connecticut.

With regard to the constant efforts made in Connecticut to extort heavy taxes from the trolley roads there, a special despatch from New Haven of Nov. 7 says: A committee of the Common Council of this city has just voted in favor of a local tax of $50 a year on each passenger car and $25 a year on each freight car of the trolley roads in the city. Its decision was made in face of an opinion of the corporation counsel that the tax is a genuine tax, and cannot be defended in court as a license fee in the exercise of police power. It is one phase of a growing conflict between the municipalities and the trolleys in this state, and which promises ere long to become very acrimonious.

The Connecticut trolley companies, except in one instance, now pay no taxes to the municipalities, but in lieu thereof pay to the state 1 per cent. on the market value of the stock and 1 per cent. on the par of their debt, unless their bonds are below par when the tax is on market value. The municipalities claim that the trolleys are localized institutions, based on local privileges obtained, and therefore ought to be taxed locally. But repeated efforts to change the existing law in the state legislature have been defeated by the representatives of the rural towns who have no trolleys and which profit by the existing system. The matter was of relatively small importance before trolley building began and when, some ten years ago, the taxes on the old horse railroads amounted to only about $15,000 a year. Now the taxes amount to about $138,000 a year and are steadily increasing.

In this situation the municipalities have adopted a series of side attacks on the trolleys. Under the general street railway law the municipal authorities are given practically complete control of layout, grades and equipment in the case of new trolley roads or extensions of old ones. They are using their powers freely to try to extort concessions from the companies as the price of authorizing new trolley plans. Thus, a while ago, in the town of Southington the local authorities demanded from a company projecting a new line that it should light the streets—a demand which a Superior Court judge held to be illegal. Again, in Willimantic, some three weeks ago, the local council under similar conditions tried to impose an annual tax of 1 per cent. on the stock of a new company. The matter was compromised by a postponement of the tax for six years. A cognate case is the demand of the New Haven authorities for the payment of $1000 down and $300 annually by the Fair Haven & Westville Trolley Company for crossing the new West River bridge and extending a few hundred feet to the Yale Athletic Field. The company has refused the demand, and the extension for which the costly bridge was primarily built is indefinitely postponed.

As a result of this attitude of the municipalities, combined with the exhaustion of trolley territory and the high price of materials, only three trolley lines—one of them small and the other two old enterprises—are now building in the state, at a period of high general prosperity.

The Telephone in Connecticut.

The legislature of Connecticut at its last session passed a general telephone law compelling existing local telephone companies, if they wanted extensions outside of the towns where they are located, and also any projected new company, to seek authority of the superior court on the question of public necessity and convenience. The finding of that court, except on questions of law, is made final, as in the case of any Connecticut trolley company seeking to parallel a steam line. The first test case has now arisen in the City of New London, where a new telephone enterprise seeks the authority of the superior court, and is opposed by the Southern New England Company. The latter corporation resists the application on the main grounds of adequate and cheap telephone service already existing, and the deformity and excavation

of streets which the new enterprise would involve. New London is one of the smaller cities of the state, and, if authorized there, the legal precedent may have considerable force in determining decisions in larger municipalities. The case is of considerable importance to any outside telephone combination seeking, through control of independent local telephone plants, a lodgment in Connecticut, and there is ground for believing that the projected enterprise at New London seeks ultimate connection with the large new combination against the Bell Company.

The Southern New England Telephone Company, which practically controls all Connecticut territory, and in which the Bell Company holds about one-third of the shares, has recently been strengthening its position by burying wires, buying up nearly all the independent companies in the state, and, to some extent, reducing rates. Besides the judicial barrier to outside or independent telephone enterprise the new statute compels a new company to pay in 50 per cent. as cash of its capital stock before beginning business and limits its bonded debt to 50 per cent. of the certified cost of construction and equipment.

CURRENT NEWS AND NOTES.

ELECTRICITY IN STATE INSTITUTIONS.—The last Bulletin of Iowa State Institutions contains a contribution by Mr. W. Michaelson, chief engineer of the Iowa Institution for Feeble-Minded Children, entitled "Electricity in the Service of State Institutions." Mr. Michaelson makes a strong plea in favor of the use of electricity in such institutions, pointing out its economy, with a properly designed plant, its safety and its utility.

A LONG ELECTRIC ROAD FOR INDIA.—Some details have been given out as to the 180-mile road proposed for the native state of Cashmere, India. Electricity has been adopted as the motive power because of abundant water power furnished by the Chenab River, which, midway between the terminal points, has a fall of 20 to 25 feet to the mile, so that a canal 7½ miles long, giving a head of 150 feet, will furnish 100,000-hp. The total cost of the road and equipment will be between $3,500,000 and $5,000,000. The government of India has lately sanctioned the construction of 550 miles of 30-inch gauge "tramways" in other provinces, and it is quite likely that some will be operated electrically. A syndicate has been formed at Simla with the object of utilizing the power of the Sutlej River near Belaspur, where it forms a loop of about 40 miles, the neck at the opening of the loop being about six miles across. The hills at that point are not more than 10,000 or 12,000 feet wide, and there it is proposed to construct a tunnel, which would give a drop of 120 feet. Five thousand to 10,000-hp will be developed to operate the Kangra Railway, the Kalka-Amballa Railway and the projected railway from Kalka to Simla. India is full of such opportunities.

AGAINST CITY OWNERSHIP.—Mr. R. P. Porter, who has recently returned from England, says: The advocates of municipal ownership in the United States are threatened with a movement in England which may knock the underpinning from their structure and bring down the edifice with a crash. The epidemic of municipal trading and interference with private enterprise may be arrested by a petition to Parliament for a royal commission, or joint committee of Parliament, to define the extent to which municipal trading shall be sanctioned by the Legislature. The contention of a large and influential body of Englishmen, who have become thoroughly alarmed at the present situation, is that individual effort in England is being crushed and enterprise stifled by municipal interference that unless a vigorous opposition is organized against these encroachments of the municipality the national consciousness will be stifled in the coils of the boa constrictor bureaucracy as effectually as it has been in Germany. The facts in relation to this important movement, which was only crystallized a few months ago, will come as a surprise to those in the United States who have accepted without question the conclusions of enthusiastic writers or half-baked economists in relation to the achievements of municipal trading in England. If only a part of the acts alleged as a basis for Parliamentary action and a halt in this tendency to state omnipotence be true, the disillusioning is likely to be as complete as it will be sudden. The immediate cause for alarm and dissatisfaction on the part of taxpayers is the increase of local indebtedness and taxation since the inauguration of municipal trading.

ELECTRICITY IN THE DESERT.—A recent communication to the French Astronomical Society gives an account of a great display of electrical action following a storm on the Desert of Sahara. About 5 p. m. on a very warm day the sky became suddenly dark, large, dark low-lying clouds rolled up and a tempest of wind and rain followed so fierce that large pebbles were carried from the ground. At the end of two hours the storm moderated, and there was then noticed at the end of the cross formed by the pommel of the camels' saddles a luminous point of violet phosphorescence. On the end of a stick raised in the air appeared a sort of blue flame like that of burning alcohol, and when the stick was moved about the flame followed, and when it was lowered the flame diminished and presently went out. The experiment was repeated by all the party with the same success, and one of them, by shaking his sword, produced a longer and more brilliant flame. At the least movement of the woolen cloaks worn a crackling of sparks was heard, like the noise of very thin glass breaking. If the hand was passed over the surface actual electric shocks were felt, whose repetition became very painful to the elbow joint. The tents themselves were electrified, and at the least contact, rubbing a camel's body, for instance, there were sparks, crackling, and commotions of variable intensity, generally quite appreciable. There was an odor of ozone while the sirocco blew, but the odor disappeared with the storm.

ELECTRIC ELEVATED TRACTION.—In regard to the adoption of electricity on the Manhattan Elevated Road in New York City, Col. H. G. Prout, editor of the *Railroad Gazette,* says: What will the public gain if the elevated railroads are electrified? To some extent this is speculative. Speed can be increased somewhat, not greatly, however, without more tracks. So long as it is necessary to run the same number of trains that are now run, on the same tracks, and to make stops as often as are now made we cannot expect much gain in speed. Electric motors would permit some increase in the average speed. By using electric motors the weight on the driving wheels can be distributed over more wheels and thus over a greater length of structure. Thus it becomes practicable to use more weight for adhesion, and that after all is the limit of speed and power. Using more weight for adhesion to the rail, a train can be picked up quicker and carried up to its maximum speed in less time and distance. Again, by using a more powerful brake the train can be stopped quicker. With electric motors, permitting more tractive weight, and with more powerful brakes, permitting quicker stops, the trains could run longer at their highest speed. Thus electric motors would permit some shortening of the average time from terminus to terminus. Furthermore, by the use of more weight on the drivers, a heavier train can be handled, and so, instead of running trains of five cars, the elevated railroads might put on trains of six cars, and increase the carrying capacity of each train 20 per cent., or they might even go up to seven cars and increase the carrying capacity of each train 40 per cent. So far as the public is concerned, these are the great possible gains by the change to electricity.

RAILWAY MOTOR CONTROL.—A patent was issued Oct. 31 to James R. Cravath on a method to prevent skidding when two or more electric railway motors are connected in series. As is well known, should one motor of, for example, a pair of electric railway motors connected in series start skidding, the increased counter e. m. f. set up by the increased speed of its armature will reduce the current flowing through the two motors, thereby causing a decrease in the tractive effort of the motors and also a decrease in speed. In shunt circuit with the armature of each motor is an electromagnet, and between the two electromagnets is pivoted a magnetic bar carrying a switch. Should one motor begin skidding, its armature e. m. f. will become higher than that of the other, thus causing more current to flow through the magnet connected with the former; this will destroy the balance between the two magnets and the switch will be attracted toward the one connected to the skidding motor. This movement will close a shunt circuit about the field of the skidding motor, thereby diverting part of the field current, which will weaken the field, thereby reducing the counter e. m. f. of the armature; consequently, the torque of the motor will be decreased until the wheels again grip the rails. This same method of regulation may be applied to shunt-wound motors by increasing the current in the field circuit instead of decreasing it as in the case of series-wound motors.

MODERN CONVENIENCES AT DAWSON.—During the past summer several new hotels have been built in Dawson City and equipped with electric light and other modern conveniences.

AUTOMOBILISM DISCOURAGED IN HOLLAND.—Automobile manufacturers who may be turning their attention to Holland as a possible field to conquer should be apprised of an insurmountable difficulty they will encounter at the start. The Flemish philologists have, according to a London paper, introduced a word into their language to express automobile. It is not pretty but it is expressive. It is snelpaardelooszoondeerspoorwegpetroolrijtuig.

WATER GAS IN BOSTON.—The manufacture of water gas is to be discontinued in Boston within a few months, and coal gas will be substituted. There has been a steady increase in the city during the last six years in the number of deaths, accidental and suicidal, from the water gas, and it is believed by the health authorities that for each death caused by this means there are one hundred persons suffering more or less from the escape of the same gas from defective pipes and fixtures inside of buildings.

SOCIETY OF NAVAL ARCHITECTS.—This body meets at the house of the American Society of Mechanical Engineers on Nov. 16 and 17. The list of papers includes the following: "The Electric Plants of the Battleships Kearsarge and Kentucky," Naval Constructor J. J. Woodward, United States Navy.; "The Increasing Complications in Warships and How Simpler Arrangements Might Be Adopted," George W. Dickie; "System of Work in a Great Lake Shipyard," W. I. Babcock; "Overhead Cranes, Staging, and Riveter Carrying Appliances in the Shipyard," James Dickie.

METAL FOIL RESISTANCES.—A patent was granted Oct. 31 to Hugo Helberger, of Thalkirchen, Germany, on a new type of electric resistance. A metallic film such as is manufactured by gold beaters and known as gold lead, silver leaf, platinum leaf or alloy leaf, is applied to a non-conducting supporting plate made of incombustible material, such as asbestos, or of ordinary pasteboard if the resistance may develop but a small amount of heat. By means of high pressure and a stamp, the foil is pressed into a board in the same manner that gold letters are imprinted by bookbinders into book covers. A coherent extremely thin metallic layer is thus formed upon the backing, which, in connection with the binding posts, may be suitably used as an electric resistance.

A NEW TYPE OF DYNAMO ARMATURE.—A patent was issued Oct. 31 to Sigmund Bergmann on a method of constructing armatures, consisting in building up the core of annular-shaped disks and interspersing at various points throughout its length, a special form of ventilating disk made by stamping the disk in a manner to leave the stamped up portions projecting at right angles to the plane of the disk. These stamped up portions serve to hold the disk at a regular distance from its neighboring disk, thus furnishing air passages for drawing out or forcing in air. As illustrated, the stamped up portions adjacent to the circumference of the disk form radial notches in which the wire forming the armature coils may be placed, and in addition there are other stamped projecting pieces between these outer ones and the central hole in the disk.

AUTOMOBILE RUN.—The Automobile Club of America had its first run on Nov. 3 in New York City, in the afternoon, when 35 vehicles started from the Waldorf-Astoria and went to Riverside Park and back, with tea at the Claremont. The parade was headed by Gen. Avery D. Andrews, president of the club, and included 22 electrics. In many respects it was inferior to the first parade in this country last June, that of the National Electric Light Association, when over 50 electrics lined up, nearly all full of ladies. In this second parade very few ladies participated. Among those present were Mr. and Mrs. A. L. Riker and Mr. A. E. Chandler, handling electrics, while Messrs. F. A. LaRoche and C. J. Field had gasolenes. There were also some steam "locomobiles" in line. The odor of the gasolene, the venting of steam, and the vibration of some of the vehicles with reciprocating engines were very noticeable. The electrics distinguished themselves by their freedom from noise, jar or breakdown. Gen. Andrews rode in an electric "Columbia," which was much admired. Mr. Riker had one of his own build and Mr. Chandler had a Woods.

AUTOMOBILES IN PARIS.—The Municipal Council is once more making an effort to render the streets safer from the growing menace of recklessly driven automobiles, numerous accidents having occurred in the immediate suburbs. Wishing to preserve to the Bois de Boulogne and other pleasure resorts that quiet and sense of repose from the noise of the city, which are their chief charms, it has recently instructed one of its committees to regulate motor traffic in the Bois de Boulogne and Vincennes. The committee's report, which is to be submitted to the Council, restricts automobiles to high roads or other regular carriage ways, the Pré Catelan, a popular resort with children, as well as all the cross alleys and paths through the wood, are strictly forbidden. Motor carriages are also prohibited from traveling on the Allée de Long Champs between the hours of 1 and 7 in the afternoon. The speed of the automobile must in no case exceed fifteen kilometers per hour; in busy or narrow thoroughfares it must not exceed a walk. The report ends by stating that these measures are not intended as vexatious restrictions on an industry which has made remarkable progress in the last few years, but are necessitated in the interest of public safety.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Every year at the Massachusetts Institute of Technology a considerable portion of the students entering is made up of those who have graduated from or have studied at colleges or universities. These students are usually prepared to begin immediately upon the professional work of the course which they choose. This year there are in all 52 such students, of whom 13 are from Harvard. Nine are graduates of Harvard, five of Brown, three of Yale and two of Amherst, while the following institutions are represented on the list of students by a single graduate each: California, Columbia, Cornell, McGill, Maine, Michigan, Minnesota, North Carolina, Princeton, Rochester, Southern Presbyterian and Vermont Universities; Acadia, Beloit, Bowdoin, Colorado, Dartmouth, Lafayette, Robert (of Constantinople), Randolph, Macon and St. Joseph's Colleges; Worcester Polytechnic Institute and the Academie de Neuschatel. A group of eleven of these students has entered the course in electrical engineering, the next largest, a group of nine, that in chemistry; while the courses in civil, mechanical and mining engineering have each been chosen by six college students. A considerable proportion have entered the courses of architecture and sanitary engineering.

STORAGE BATTERIES.—Among the patents issued Oct 31 were two on storage batteries, one granted to Arthur Heinemann and William Schafer, of Berlin, Germany, and the other to Albert Edward Hodgson, of Halifax, England. The former is on a type of dry storage battery. The usual electrodes are placed in a battery cell constructed of any suitable material, and a filler consisting of non-conducting charcoal is tamped more or less firmly into the spaces between the electrodes, and also into the spaces between the electrodes and the battery vessel, the electrodes thus being completely imbedded in the non-conducting carbon. The carbon is then saturated with the usual solution of sulphuric acid to such an extent that on tipping the vessel over none of the solution will flow off. The inventors state that chemically pure charcoal possesses great advantages for such a use as proposed, through being a non-conductor of electricity, and absolutely indifferent to the action of the electrolyte as well as to the action of the electric current, while at all times and under all circumstances it remains in intimate contact with the electrodes so that no more than sufficient electrolyte to saturate the powdered carbon is necessary. It is also stated that a charcoal freed from its organic and inorganic impurities also possesses, in view of its porosity due to its cellular structure, an extraordinary power of absorption for liquids and affords free passage to gases. Such charcoal also prevents the formation of crystalline lead sulphate, this property being accounted for by the high absorptive power whereby the sulphuric acid radical is mechanically and so firmly bound that the electrolytic decomposition necessary for the combination of the oxygen and hydrogen ions alone can take place, thus preventing the secondary formation of crystalline lead sulphates. It is stated that the voltage of a charcoal filled battery is from .1 to .3 greater than that of the most efficient storage batteries of equal capacity hitherto used. The Hodgson patent relates to the use between electrodes of separating mats made of a woven glass flexible fabric. The fabric or separating mat is made up by plaiting spun glass yarns or threads to form a mesh, the ends being fused by heat so as to form edges to the mat.

ENGINEERING SOCIETY LIBRARY, UNIVERSITY OF MICHIGAN

ALUMINUM ELECTRIC CABLE.—The Hartford Electric Light Company will complete within the next two weeks the installation of its aluminum cable between the new power house in Tariffville, on the Farmington River, and Hartford. The cable has seven strands and a diameter of three-fourths of an inch. It weighs about 1500 pounds to the mile, or nine tons for the whole line. The cable is not insulated, as is the copper cable which brings the 10,000-volt current from the Poquonock power house. The poles are short and very strong. No trouble is apprehended from weather conditions, as the cable is so light that no amount of snow or ice which may accumulate on it in winter is likely to break it. The cable has been furnished by the Pittsburg Reduction Company, and its use in Hartford will, it is said, be the first practical electric test of aluminum on a large scale and over so long a distance.

AUTOMOBILE MECHANISM.—Three patents were granted Oct. 31 on electric automobile mechanism—two to Elmer A. Sperry, Cleveland, O., and the third to Louis Krieger, of Paris, France. The first mentioned patents are in too great detail for abstract here, one consisting of 45 claims and the other of 14. The first mentioned is on a controller system whereby starting, varying the speed and instantaneously stopping may be accomplished with the least possible inconvenience to the operator and with slight effort on his part to place under control electric friction brakes far more powerful than mechanical brakes, which brakes are applied to all the wheels of the vehicle simultaneously instead of only to the driving wheels, as usual. The patent also relates to details of construction and arrangement of parts tending to cheapen the production of electric vehicles. The second patent is on a means for interlocking various operations connected with the control and braking, to provide an automatic speed regulation, a variable or graduated resistance to the action of the brake, means for causing the magnets to instantly release their hold upon the parts which they grasp or retard, various connections between such magnets and the generators or other source of electrical energy, and other details and arrangements. The Krieger patent is on an arrangement for driving through the wheels of the fore-carriage, at the same time allowing of the steerage of the vehicle by means of the fore-carriage. There is an independent motor for each wheel, the frame being pivoted on the axle and the wheel driven by a pinion on the armature shaft engaging with a gear secured to the wheel. The field magnet winding of each motor takes but half as much current as the armature. That is to say, if 50 amperes pass through the armature, the field magnet winding must be made for 25 amperes. Change of direction of movement is effected by electrical braking one or other of the two motors by short-circuiting the corresponding armature. The steering apparatus has a centre at the point of rotation of the fore-carriage, and carries a contact plate by means of which electrical connection is made with the motor circuits.

ELECTRICAL MEASURING INSTRUMENTS.—Four patents were granted Oct. 31 for electrical measuring instruments, two to Prof. Elihu Thomson, one to Frank W. Roller and a fourth to Vittorio Arcioni, of Ivrea, Italy. The latter relates to a measuring instrument of the hot-wire type. Of the several pulleys over which the hot wire passes, one is mounted near the fixed end of a steel spring, the other or free end of the spring giving motion to the indicating pointer. As the wire becomes heated in taking a measurement it expands, and the steel spring in tending to keep the tension on the wire constant moves in a direction which carries the pointer connected to the free end along the scale. The parts are so designed as to give a large arc on the scale, with equal divisions for equal increments of currents passing through the instrument. The Roller patent is on a damping arrangement for obtaining dead-beat indications from the usual type of electrical indicating apparatus. On the pole ends of the usual magnet employed in these instruments are fixed two extension pieces of magnetic material; the extension piece from one pole is forked, the bifurcations overlapping the extension piece from the other pole. Two magnetic air gaps are thus formed—between the central and overlapping extensions—and in these gaps is a loop formed of copper or other conductive material and secured to the opposite end of the indicating pointer. When motion is given to the pointer, eddy currents are set up in this loop through the influence of the magnetic field, the result being to dampen the movement of the pointer. The earlier in date of application of the Thomson patents is on a summation watt-hour meter, consisting of an auxiliary device for duplicating at any point the readings of a watt-hour meter, or for summing up the readings of any number of different watt-hour meters. The apparatus, which is comparatively simple in construction and may be operated by a primary battery of moderate size, consists of an electromagnetic ratchet device operated at intervals by the meter, the sum of whose readings it is desired to give on the auxiliary dial. At the watt-hour meter itself, the only operation consists in closing at each revolution of any convenient point therein a circuit for energizing the electromagnets. The apparatus may be applied to any number of electric meters, and may be used in connection with measuring devices of other classes, such as gas meters, the rotation of different shafts, the successive impulses of a number of different machines, or in general, the integration of a number of different commensurable movements. It may also be applied by arbitrary proportioning to the measuring of totals in different units, as might sometimes be desirable in stations operating a mixed system of gas and electric lighting, where the total output of current in cubic feet of gas might be reduced to a pecuniary basis and recorded in dollars and cents. The second Thomson patent is on a watt-hour meter in which, instead of the usual method of obtaining a retarding torque by means of the generation of eddy currents, a method is employed based upon the use of centrifugal force. It is well known, first, that the development of centrifugal force varies as the square of the angular velocity of the rotating body, and second, that the repulsion or attraction of a current-carrying coil which is within the influence of another current-carrying coil will vary as the square of the total current in such coils when they are in series or in parallel to each other. As applied, there is a centrifugal governor on the meter shaft, the acceleration of which is checked by the opening of a switch when the speed of the shaft increases to a point where the effort produced by the centrifugal action of the governor is greater than the repulsion effort between the series coil of the meter and an auxiliary coil in multiple connection therewith. This auxiliary coil consists of a coil about an iron core, the whole entering axially within the meter series coil, and resting on extensions to the governor arms in such manner as to cause the above-mentioned switch to be open at no load, said switch controlling the armature of meter pressure circuit. As soon as a load comes on the meter, the repulsion between the series and auxiliary coil increases the pressure of the latter on the extensions of the governor arms sufficient to close the armature circuit, when the armature commences to revolve. The higher speed then causes the switch to open by the action of the governor, and the armature will run more slowly until the effect of the coils is sufficient to close the circuit again. This action continues intermittently during such time as the load is on the circuit. If the load doubles, the repulsion between the two coils is increased four times, which causes the motor to accelerate; but at double speed the centrifugal force of the governor increases four times, and the contacts will now open and close intermittently, as before. This action results in a change of the rate of revolution for every change of load and in proportion to the change of load.

LETTERS TO THE EDITORS.

Grounding of Low-Tension Circuits.

To the Editors of Electrical World and Engineer:

Sirs:—I have read with interest the article by Messrs. W. B. and L. C. Reed in the ELECTRICAL WORLD AND ENGINEER of October 28, on "The Protection of Interior Wiring from High Potential Wires." The point raised by them goes far to confirm the position of the underwriters that the permanent grounding of one side of low-tension circuits could only be sanctioned as the choice of the lesser of two evils, and thus far the underwriters have taken the position that they are not convinced but what this choice might be the greater of the two evils.

The carefully considered expressions of opinion on this subject are of great assistance to the underwriters in reaching a satisfactory solution of the problem, and should any of the readers of the ELECTRICAL WORLD AND ENGINEER have any suggestions to offer as to *how* and *where* the permanent ground shall be made, should a rule allowing or requiring such a ground be adopted, the underwriters would be pleased to receive such suggestions either through the columns of the ELECTRICAL WORLD AND ENGINEER or by direct communication.

C. M. GODDARD.

55 KILBY STREET, BOSTON, MASS.

Water Wheel Governors.

To the Editors of Electrical World and Engineer:

Sirs:—We note on page 482 of your Sept. 30 issue, in the article by Prof. F. W. Springer, on the St. Cloud, Minn., water power electric plant, a reference to our old slow acting electric governor, which may be misconstrued to the disadvantage of our present types of water wheel governors.

The governor referred to is one which was put out some nine or ten years ago, before electric railways attempted to use water power. Since then water wheel government has been revolutionized, and the old type of electric governor, admirable as it was for light changes of load, was never intended for the severe work to which this particular governor has been put, as it had no relay device whatever for cutting it out of action to prevent overrunning. However, had even this old type of governor been on the lighting instead of the railway load, it would have given satisfactory results, and it would be well for parties interested to inquire what the results would have been had the other governor, favorably mentioned by Prof. Springer, been put to the test of the railway load. We hardly suppose the writer of the article intended to do us any injustice, but it would have been just as well to have called attention to the disadvantages under which the governor in question is working. W. C. PARSONS.

AKRON, OHIO.

Dark Lightning.

To the Editors of Electrical World and Engineer:

Sirs:—I am sending you herewith a photographic print of a lightning flash taken about 9:30 p. m. Aug. 28, 1899, at Minneapolis, Minn. The camera was pointed due north toward the approaching storm, and after about one minute's exposure the main flash in the picture was recorded on the plate. The rain had not begun to fall at the time, and as the camera was exposed at the edge of the veranda of a residence, when the rain drops began to fall the camera was moved back under shelter without putting the cap over the lens and a second flash was waited for, which was so far to one side as to give a record of only a small part of itself. The principal interest of the plate attaches to the very distinct records of "dark lightning." Near the middle of the flash a small "dark flash" starts off to the left and continues to the earth, apparently independent of the main flash and growing heavier as it nears the earth. Also near the earth on a white flash are several dark branches showing very distinctly, and seeming to prove the theory that dark lightning photographs are due to a "reversal of the photographic image," mentioned in your editorial of Oct. 28. These dark "branches" appear certainly to come from the white flash, and one would hardly expect the photographic image of a part of a bolt of lightning to reverse, and not the whole of it. TRUMAN HIBBARD.

HUDSON, WIS.

[The dark flashes mentioned show on the print, but so faintly that in photographic reproduction the traces were obliterated.—EDS.]

Professional Degrees.

To the Editors of Electrical World and Engineer:

Sirs:—In view of the requirements for graduation in the majority of our American technical schools, I am of the opinion that after graduation the student should be required to take one additional year of graduate study under the guidance of his instructors before the degree of M. E., E. E. or C. E. is conferred; or that, if it be impossible for him to longer attend school, the degree should not be conferred until the candidate shall have had at least two years' experience in the practice of engineering.

In any case the candidate should be required to prepare a thesis that evidences solid work and good engineering ability, and pass an examination that will establish beyond a doubt his fitness to receive his degree.

The engineering profession does not, I believe, and certainly should not, judge a man by the degrees he holds. The degree is merely an index of what we may expect. In every case I believe we measure the man, even to the extent of acknowledging as equals some of the men who are "just out of college."

The "engineering quality" of the product of our technical schools is a very variable one, some very good, some very bad, and it usually depends upon the natural engineering ability of each individual student. As a general proposition, engineers are born, not made.

In my judgment the M. E., E. E. or C. E. degree is as legitimate to its holder as the M. D. degree, every bit.

Purdue University,
LAFAYETTE, IND. W. E. GOLDSBOROUGH.

To the Editors of Electrical World and Engineer:

Sirs:—Replying to the questions asked by Mr. R. Rimanoczy, the opinions of the University of Toronto, and its affiliated institution, the School of Practical Science, as embodied in their regulation concerning professional degrees in engineering, are as follows:

1. That the degrees of M. E., C. E. or E. E. should not be conferred after four years of undergraduate work.

2. That a total of three years of actual engagement in engineering practice should be required.

3. That a thesis should be presented, on an engineering subject within the field represented by the degree, and treated from the standpoint of the engineer.

The University of Toronto confers the degree of B. Sc. after four years of undergraduate work in engineering, accepting the view of the profession that professional degrees should not be granted immediately at the close of an academic course. Referring to the comparison with the degree of M. D., it may be said that a course in a medical school properly contains much that is identical with a physician's subsequent practice, while in engineering, unless the comparatively large field of necessary preparatory work is to be slighted no adequate engineering experience can be given.

School of Practical Science.
TORONTO, ONT. T. R. ROSEBRUGH.

To the Editors of Electrical World and Engineer:

Sirs:—Referring to the letter of Mr. Rimanoczy, in your issue of October 21, my own opinion is that the undergraduate engineering course should lead to the degree of Bachelor of Science, as such a course is intended to lay the educational foundations upon which the work of the engineering profession may be laid. Much engineering practice can be taught in college, and is there taught, but no college can make an engineer. The practice of giving the degree of Bachelor of Science at the end of undergraduate courses in engineering is followed by the University of Wisconsin in common with numerous institutions, such as the Massachusetts Institute of Technology, the University of Pennsylvania, and other widely known colleges and universities.

The medical course, which leads to the degree of M. D., as a rule, is strictly a course of instruction in practice, and the physician's work after leaving college does not have so wide a bearing upon business and sociological questions as does the engineer's practice. The practice of the physician is limited within quite narrow lines and, therefore, a special professional course can more distinctively prepare a physician for his practice than is possible in engineering. A considerable part of the preparation of the young engineer must be had through experience in actual engineering work, and it therefore must be had outside of the college. The practice of the engineer is so wide that it is necessary for a substantial educational basis to be laid down, and for this reason the undergraduate courses cannot be so narrowly limited to technical matters as is true of medical and law courses.

It must be remembered that a feeling is arising that the medical schools and law schools should found their courses upon the basis of a regular college course previously pursued. If such an arrangement could also be made in the case of the engineering courses, the strict technical applications of science could be more fully treated in the engineering schools, and the granting of engineers' degrees at the completion of the course might then be fully justified.

University of Wisconsin.
MADISON, WIS. D. C. JACKSON.

To the Editors of Electrical World and Engineer:

Sirs:—Would it not be a good thing if the universities should unite as to the meaning to be attached to their degrees? I would suggest the following:

B. E. E., B. M. E., etc., for graduates from the technical schools.

M. E. E., M. M. E., etc., for graduates who have by the performance of practical work in their profession, such as the construction of well designed plants, or researches on engineering questions, shown that they have a thorough working knowledge of their profession.

D. E. E., D. M. E., etc., reserved entirely for men who have done eminent work in their profession, i. e., work out of the ordinary and work tending to advance the practice of the profession.

At present, in some universities, a man may become a doctor, in his profession, with no more savoir faire than a schoolboy.

We also need a distinction between the learnings and sciences. I have a colored janitor who, in the exercise of his profession, i. e., dusting, has seen fit to classify my galvanometers into "three-legged with pointed top," "three-legged with round top," etc., varieties. He does not pretend to be an electrician, and, so far, has never applied for a doctor's degree on the strength of his knowledge of classification. I had the pleasure of the acquaintance of another gentleman who had spent considerable trouble in classifying butterflies according to their markings. He is entirely ignorant of the internal workings of these beautiful beings, and does not know how to use a section cutter. He is, however, a Ph. D.

It seems to me that there are at least three broad classes of university studies—the sciences, the humanities, and the learnings—and that the degrees should be made accordingly. At present some degrees, especially the Ph. D. degrees, are much abused.

Western University of Pennsylvania,
ALLEGHENY, PA. REGINALD A. FESSENDEN.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Low Voltage Dynamos.—SCOTT.—A short illustrated article on the design of dynamos for electrolytic works, which present special difficulties at the commutator and brushes. A special commutator seems needless as the armature bars can be arranged to serve the purpose. Reference is made to a dynamo built by the Brady Mfg. Co., of Brooklyn, in 1891, which is said to have been very successful in metallurgical work, giving 40 volts and 3000 amp. at 240 rev. per min., the current increasing to 5000 amp. on short circuit. It was of the two-pole type with the poles placed vertically and the brushes rested against the armature bars in the spaces between the pole horns. In the two-pole type the conductors cannot be thoroughly laminated, and the Foucault current loss is therefore large; but in the multipolar form of Siemens & Halske the internal pole design with Gramme armature, is said to get over the difficulty entirely; this design is illustrated and claimed by the author to embody all the essential features of a low potential machine. Very ample brush surface is obtained so that cheap carbon may be used at its normal current carrying capacity of 35 amp. per sq. in. or even lower. As the cost of copper for the commutator is at least 5 per cent. of the total cost of material, a considerable saving is effected by dispensing with the commutator altogether. In electrometallurgical machines liable to short circuits, it is important to keep the field relatively strong, which is best accomplished by having a smooth-core armature and a long air-gap, at the same time the bars must be held very securely on account of their having to resist suddenly varying tangential pulls. The construction adopted by the Oerlikon Co. in the machines for the Falls of Foyers is described and illustrated.—Lond. *Elec.,* Oct. 20.

Compensated Field Alternators.—A description of the new type of machines to which this title has been applied by the maker, the General Electric Company. The machines embody an entirely new principle of excitation and regulation. The exciter of each is direct coupled to the shaft of the alternator and has the same number of poles as has the main machine. The outgoing currents of the alternator pass through series transformers, the secondaries of which are tapped through collector rings into the armature of the exciter. The result is that the load of the alternator sets up a reaction on the field of the exciter, tending to raise the voltage of that machine. Further, if the alternator load becomes inductive, the reaction on the field of the exciter swings more into line with the main field and still further increases its boosting effect. Thus the machines regulate automatically for loads either inductive or non-inductive and the rating of the dynamos can be considerably increased without fear of poor regulation.—*Amer. Elec.,* November.

REFERENCES.

Alternators in Parallel, Driven by Gas Engines.—DETTMAR.—A paper read before the Union of German Electrical Engineers, in which he describes his method of synchronizing with the aid of an adjustable magnetic eddy-current brake made to act on the fly-wheel, which is in use in the Bentheim-Gildehans plant, as described in the Digest July 29. The brake is illustrated.—*Elek. Zeit.,* Oct. 19.

Starting and Regulation of Continuous Current Motors.—GUILBERT.—Brief, well illustrated descriptions of recent improvements taken from patent specifications.—*L'Eclairage Elec.,* Oct. 14.

Contact Resistance of Carbon and Copper Brushes.—ARNOLD.—An illustrated French translation in full of the article abstracted in the Digest Jan. 28.—*L'Elec.,* Oct. 21.

LIGHTS AND LIGHTING.

Public Lighting Systems.—A very long editorial on the best system to adopt for street lighting. If the radius of supply from the station is not prohibitive, a three-wire continuous current system at 440 volts between the outers is said to be the best on account of the unquestioned superiority of continuous current for the supply of arc lamps. For more extended districts the rotary converter substation system offers quite similar conditions. If, however, the public lighting has to be undertaken from a single-phase alternating current station, the system to be adopted turns largely upon the relative efficiency of alternating and continuous current arc lamps and their respective associated devices. For running continuous current arcs at from 10 to 12 amperes and alternating arcs at 15 amp., an alternating lamp has to be supplied with from 50 to 60 per cent. more power than a continuous current lamp for the same useful effect. The stability of the arc has also to be considered. For extended districts the following five high pressure systems, in addition to the rotary converter substation system, are briefly discussed: the rectifier system which in many cases is said to be the ideal high pressure arc lighting system; the continuous-current series arc system; the series-parallel continuous-current system; alternating arcs, with separate transformers run from constant high pressure circuits; and alternating arc lamps in series, with choking coils across their terminals. A comparison of open and enclosed arc lamps is added. The use of enclosed arc lamps greatly reduces the items of carbon renewals and attendance, but the sum thus saved may be equaled or exceeded by the cost of extra electrical energy expended on account of the lower efficiency of the enclosed lamps. It is pointed out that an enormous gain in efficiency is obtainable by the use of a high current density, but that in general, in order to get a 100-hour life, 13-mm carbons are used for currents of 4 to 6 amp., while this size of carbons is more suited to a current of 25 amp. A better compromise might be to use 5-mm or 6-mm carbons and be content with a 32-hours' run, which is claimed to give better light radiation, a cleaner enclosing globe, a reduction of the wandering of the arc, allowing the use of less dense and more efficient globes with equal steadiness of light, and a gain in efficiency up to 100 per cent. Compared with incandescent lamps at three watts per candle, the only advantage of enclosed arcs for street lighting seems to consist in the much better diffusion of the light; incandescent lamps, however, allow the light to be subdivided better.—Lond. *Elec.,* Oct. 20.

Incandescent Lamp Filaments.—A description of the advantages and difficulties involved in long filaments for incandescent lamps, pointing out the fact that such filaments are now made in part of "base" and in part of "graphitic" or deposited carbon. The former is the result of carbonizing the cellulose thread from which practically all lamp filaments are now made, and the other is deposited upon it by the "flashing" or "treating" process. The graphite gives

the filament far better surface for the economical production of high temperatures ,and greatly increased durability and life, but it has only about one-sixth the specific resistance of the "base" carbon. On this account if much graphite is used the filament must be very long and thin. Various expedients are used for supporting such long thin filaments, the most popular being the oval-anchored arrangement and the division of the filament into two separate loops connected in series with each other.—*Amer. Elec.,* November.

Photometry of Incandescent Lamps.—LIEBENTHAL.—An exhaustive theoretical and practical treatise on the luminosity of an incandescent lamp, the accurate measurement of which is complicated by the want of symmetry in the emission and by reflections from the glass wall. The simple curved filament, hollow or solid, single or in pairs variously disposed, shows the greatest regularity in the distribution of the light round the axis of the bulb. The looped filament shows strong reflections in two opposite directions. Filaments of wavy outline show decided minima in the plane containing the terminal points of the filament. To obtain an average luminosity characterizing the lamp as a whole, the Union of German Electrical Engineers has adopted a system of two mirrors, which show the lamp as though it were seen from three different points simultaneously. It has also been proposed to make the lamp revolve about its axis, but this leads to a centrifugal deformation of the filament.—*Zeit. fuer Instrum.,* July, August; abstracted briefly in Lond. *Elec.,* Oct. 20.

POWER.

83 Miles Power Transmission.—LIGHTHIPE.—A well illustrated description of a plant designed for 10,000-hp at 33,000 volts, transmitted from Santa Ana River to Los Angeles, a distance of 83 miles. Three-phase current at 750 volts is generated by rotating field alternators of 750-kw, direct coupled to Pelton water wheels, and is transformed up to 19,000 volts by twelve transformers of 250-kw connected in groups of three, with the primaries delta connected and the secondaries Y connected. The transmission line consists of two circuits each of No. 1 B. & S. copper wire. In Los Angeles the power is transformed down in two substations for distribution through the city. At Shorb, about six miles from Los Angeles, the main lines are tapped and branched to a substation in Pasadena, where the current is used for lighting and, after having been converted to 500 volts direct current, for the famous Mount Lowe Railroad. Pomona, 33 miles from Los Angeles, is also supplied with current for lighting. At Colton, 23 miles from the power house, the lines of the Southern California Power Co. and the Redlands Elec. Light & Power Co. are temporarily tied together in the following way, in order to help out the latter company until the completion of their new power house: The current is transformed from 30,000 to 2200 volts by two 150-kw transformers, placed on two sides of the triangle and then raised to 10,000 volts to match the Redlands circuit by placing three 40-kw transformers with a ratio of 2200 to 10,000 volts in parallel on one side of the triangle and a 100-kw transformer on the other side. The latter transformer being wound for 10,000 to 2500 volts, it was necessary to boost up the secondary side to make the ratio the same as in the other leg, which was accomplished by two small transformers with the primaries in series and the secondaries in parallel.—*Cassier's Mag.,* November.

Electric Cranes.—An illustrated description of some British overhead electric traveling cranes. One-motor and three-motor cranes are in the market in England, direct current being almost always used. There are several one-motor cranes on which the alternating current is used. Series motors are preferred. The speed of a "crab motor" should not exceed 300 revolutions; motors should be liberally rated. In general the speed of a 300-ton crane with light loads is 250 feet per m. longitudinally, and 150 transversely. Spur gearing with an automatic brake is generally preferred to worm gearing. Some data from a test are given. For switches the liquid type of resistance with the reversing switch combined, is favored, the usual arrangement consisting of a cast iron trough with a solution of caustic soda. The handle operates simultaneously a commutator of two sections, positive and negative, and the resistance plate which makes contact with the liquid.—*Cassier's Mag.,* November.

TRACTION.

Predetermination of Storage Batteries for Tramway Power Houses.—BRANDT.—An account of an investigation made for Siemens & Halske to find an exact method for predetermining both the number and size of the cells for traction power houses. A series of experiments were made in which there were large and sudden changes of load and reversals of current. He uses the term "characteristic resistance," which for a given change of voltage and current in any part of the circuit is defined to be that ohmic internal resistance which, if it were the only cause, would produce the given variation of voltage and current. If, for instance, the dynamo voltage is 500 for 400 amperes and 450 for 600 amperes, the characteristic resistance for this variation is 0.25 ohm; or if a battery has 500 volts on open circuit and 550 after being charged by a current of 200 amperes during two minutes the characteristic resistance for this current is 0.25 ohm. The experimental results are summarized as follows: The characteristic resistance of a given battery does not depend on the value of the load but only on its duration; the influence of the preceding load of opposite sign disappears almost entirely during the first minute after the new load has been applied; the average voltage to give the best effect depends only on the qualities of the batteries. He shows analytically how to predetermine a battery, assuming that it supplies only the excessive loads of longer duration, the short, momentary rises not being considered. The most unfavorable cases of variation of load should be considered. The contributions of the dynamo and the battery to the impulses of current are in the inverse ratio of their characteristic resistances and this gives a method of calculating the battery. The formulas developed seem to be practical but cannot well be given here. A further article is promised.—*Elek. Zeit.,* Oct. 19.

German Street Railway and Light Railway Association.—An account of the proceedings of the fifth general meeting which was held Sept. 11 and 12 at Elberfeld-Barmen. The membership includes over 80 per cent. of the German street railways and a large number of light railways. The subject of fenders was discussed in the annual report and the experience seemed to be that a simple board carried in front of the wheels is more desirable than a fender carried on the dash board. One advantage claimed for it is, that it increases the braking distance by from two to three meters, thus giving the motorman more opportunity to stop the car. A record of accidents on forty-five street railways, most of them electrical, is given. The average was one accident to each 700,000 trail car miles and one accident to every 250,000 motor car miles. An article on track construction was presented by Géron. The ordinary cast-welded joint is not used to any great extent. Dr. Goldschmidt, of Essen, described his system of welding. He first prepares a mixture of aluminium and iron oxide in a crucible; when this is ignited a high temperature is generated, the iron is set free and the aluminium combining with the oxygen of the iron forms a kind of corundum which floats on the top of the mixture. The temperature produced is about 3000° C., and five minutes only are required to get the mixture into a molten state. The mixture is then poured around the rail, making an excellent joint. The strength of the joint is about three-fourths of that of the rail, 100,000 lbs. per square inch. The cost of a complete joint at the present time is said to be $5. Another paper described a novel railway over the Wupper River at Elberfeld. This is an elevated monorailroad and is illustrated; the cars are suspended from the structure and the axles are driven by motors. The car bodies are 38 feet in length and have a centre aisle. At curves the centrifugal force produces an inclined position of the cars which at the sharpest curves (295 feet radius) amounts to only 7½ per cent.—*St. R'y Jour.,* Int. Ed., November.

Traffic and Transportation Facilities of Vienna.—ZIFFER.—An article stating that in 1897 the omnibuses carried 14,600.000 passengers, the Vienna Tramways Company 64,000,000, the New Vienna Tramway 10,000,000 and the remaining lines 6,000,000. The opening of the stadtbahn had an unfavorable effect on the traffic earnings of the other roads, but he thinks this is only temporary, and that when the latter are equipped with electricity they will regain their lost traffic. The lines in Vienna are being electrically equipped by a company, the capitalization and franchises of which are fully described. The writer also describes the passenger depots of the new Wienthal line. This is mostly in a subway underground, and the stations are connected with the surface by electric elevators.—*St. R'y Jour.,* Int. Ed., November.

Electricity on Trunk Railroads in Italy.—A very long article on the substitution of electricity for steam on the trunk railroads in Italy, a country in which there is little coal but which is rich in available water powers. A committee of officials of the government and of representatives of the railroad companies, proposed to start the introduction of electric traction on the following lines: from Milano to Monza, and from Bologna to San Felice, both by accumulator

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cars; from Rome to Frascati by a combined third-rail and trolley system; from Chiavenna to Colico, Lecco and Sondrio by the conduit system. The first part of the very long abstract from which this is taken gives a description in detail of the Milano-Monza line which was referred to in the Digest April 8 and Sept. 2.—*Zeit. des Ver. deut. Eisen. Verw.*, No. 74, 76; the first part of a very long abstract in *Zeit. fuer Elek.*, Oct. 15.

Electric Tramway in the British West Indies.—HOLGATE.—A well illustrated description of the tramway in Kingston, Jamaica. Water power is used, two pairs of 21-inch horizontal turbines being directly coupled to two three-phase G. E. alternators of 550 volts and 300-kw. The current is transformed up to 14,000 volts by six transformers and transmitted over a line of 21 miles to a substation, where it is transformed down to 350 volts by six transformers and converted into continuous current by two synchronous converters of 200-kw.—*Cassier's Mag.*, November.

An Electric Railway in Central America.—CASEMENT.—An illustrated description of the tramway system of San José, Costa Rica. The power is hydraulic, the generating station containing a Leffel turbine coupled to two 300-kw three-phase alternators. This supplies both the lighting system and a motor-generator set at a substation which transforms the three-phase current to direct current of the standard railway pressure.—*Amer. Elec.*, November.

Car Mileage.—MACKAY.—An article in which the writer criticises unfavorably the usual unit for comparison of traffic, viz., the car mile, and thinks the ton mile equally undesirable. As a substitute he recommends the "motor-car hour;" this enables a fair comparison to be made of the operating expenses and receipts, between a city tramway, where the speed is limited, and a suburban line, where higher speeds are attained.—*St. R'y Jour.*, November.

Electric Cabs in Paris.—After exhaustive trials a large company in Paris owning 8500 vehicles and 12,300 horses, has decided to gradually abandon horse traction and to adopt electric automobiles, using the Bersey system, the one used in London, on account of its simplicity. Steering is accomplished by a worm wheel attached to the front axle and is claimed to be sufficiently quick and not reversible. There are 43 cells weighing 1760 pounds, but no data are given concerning the capacity. There seems to be only one motor, which is drum wound and weighs 211 pounds, being rated at 3-kw at 1500 revolutions. Driving is through a Sebin chain.—*Automotor Journal*, June; abstracted in *Science Abstracts*, October.

REFERENCES.

Street Railway Convention.—A full account of the proceedings of the recent convention in Chicago.—*St. R'y Jour.*, November; *St. R'y Rev.*, Daily Ed., Oct. 17, 18, 19, 20; a brief abstract in *Amer. Elec.*, November.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Charging for Electricity.—A short article on the methods of charging at Whitechapel. In summer the charge is 2 cents per unit (kw-hour); during the winter there are two scales at the option of the consumer, either 2 cents per unit and a monthly rental of 25 cents for the equivalent of each nominal 8-cp lamp used; or 2 cents per unit after the lamps have been used 60 hours per month and the electricity consumed during these 60 hours charged for at 16 cents per unit. The charges are based on the maximum number of lamps used simultaneously, not on the number actually installed. In the case of motors, the maximum horse-power developed, and not the rated capacity, governs the charge; with efficient motors one horse-power may be taken as the equivalent of 30 nominal 8-cp lamps. A table shows the average annual cost of electricity for different purposes and gives a comparison with the cost of gas light, the latter being much more expensive in nearly all cases.—Lond. *Elec. Eng.*, Oct. 20.

Storage Batteries.—An editorial note criticising the article of Adams (Digest, Oct. 14) in which he advocated replacing many of the isolated electric plants by storage batteries charged from the public supply mains on a tariff for continuous supply during the 24 hours. It is stated that when the interest, depreciation and cost of attendance on a storage battery are taken into account, if it is economical to level a consumer's load curve by this means, the same would apply to the supply station itself; experience has shown, however, that it does not pay a public supply station to include in its equipment a storage battery large enough to level the highest peaks of the load curve.—Lond. *Elec.*, Oct. 20.

Electricity for Agricultural Purposes.—A note stating that a company of farmers in Samter County, Germany, has made a contract with an electric company to build a central station in that county for the distribution of electric energy over an area of a radius of 16 miles for power and lighting purposes, more especially for driving agricultural machines. The cost is $1,300,000. Contracts have been signed for plowing a large acreage by forty electric plows in a certain time. In a recent publication of the General Electric Co. of Berlin it is stated that there are numerous smaller isolated plants in other parts of Germany where electricity is used for driving agricultural machines.—*Elek. Zeit.*, Oct. 19.

Rubber Works Electric Plant.—An article on the substitution of electricity for steam, for driving the motors in the extended Goodrich works in Akron, O., and also for lighting; the installation is now under construction. Three steam engines drive three two-phase generators, two of 500-kw and one of 150-kw, which are arranged to work in parallel. About 60 induction motors are scattered over the works, varying from 1 to 300-hp, with a aggregate capacity of 2000-hp. Some of them are attached directly to individual machines, such as tube mills, calendar rolls, elevators, etc. The lighter machines are connected by belts to shafting, and a single motor drives a group of them.—*India Rubber World*, November; *West. Elec.*, Oct. 28.

Leicester.—A well illustrated description of this plant which is the first in England equipped entirely with the inductor type of alternator. The alternators, built by Ganz & Co., in Budapest, are described in detail and illustrated by diagrams; they are rated at 200 amperes and 2200 volts. The excitation is sufficient to keep the voltage up to 2200, even when supplying 200 amp. with a power factor of 0.7; the frequency is 50. A large demand for motors has also arisen, the inductor type of motors being used.—Lond. *Elec. Eng.*, Oct. 20.

A Ship Lighting Plant.—A description of the electrical equipment of the new White Star steamship, the Oceanic, the largest ship in the world. The lighting plant consists of four 60-kw direct-coupled sets arranged in two pairs, one in the port and one in the starboard engine rooms and on the intermediate platform aft of the main engines. The hull of the ship is used as a return on the negative side of the system which greatly simplifies the wiring and the switchboard. No field rheostats are used, the voltage and division of of the load between the generators being adjusted by varying the speed of the engines, which speed is controlled by throttle governors operated by shaft governor weights. Current is carried through the ship in single-conductor, lead-covered and steel-wire armored cables, no conduits being used. The ship is also fitted with a telephone system, the bridge being so far from the crow's nest and the forecastle head on this mammoth craft that telephone communication with these points is necessary.—*Amer. Elec.*, November.

REFERENCES.

Switchboard Connections.—A discussion of the necessary arrangements for throwing the voltmeter on to the various phases of the several generators of a polyphase system connected to one switchboard. It also takes up the arrangements necessary for synchronizing the different generators with each other. The switchboard connections approved and used by the Westinghouse Company are given in four diagrams, illustrating respectively the circuits of high-tension two-phase, high-tension three-phase, low-tension two-phase and low-tension three-phase generator panels. Some ingenious arrangements are described whereby the number of points in the voltmeter receptacles are reduced to a minimum and the synchronizing circuits are greatly simplified.—*Amer. Elec.*, November.

Special Circuit Switches.—Diagrams showing the different arrangements of circuits and switches for special purposes, such as switching off the same lamps from two or more different points, for staircase lights, etc.—Lond. *Lightning*, Oct. 19.

Automatic Lamp Switch.—HORWITZ.—An illustrated description of a device for automatically switching a second lamp into circuit when the first one fails; it is based on the action of an electromagnet on its armature.—*Zeit. fuer Beleucht.*, Oct. 20.

Berlin.—The second part of the well illustrated article noticed in the Digest Nov. 4, describing the six 1000-kw dynamos furnishing continuous current of 250 to 280 volts, at 85 revolutions per minute. Two dynamos are driven by each of the three 3000-hp steam engines. —*Zeit. fuer Beleucht.*, Oct. 20.

Voltage Curve.—A reproduction, with a short description, of the recording voltmeter curve at the Bradford station, England, showing the fluctuations in voltage during a recent cable breakdown.—Lond. *Elec.*, Oct. 20.

WIRES, WIRING AND CONDUITS.

Overhead Wiring.—A full reprint of the report of Walckenaer to the Board of Health of Paris on high pressure overhead wiring, sug-

gesting that the allowable limit be 600 volts for continuous currents and 120 for alternating currents. The chief of police has issued an order in accordance with this proposal.—*L'Elec.*, Oct. 21.

REFERENCES.

Polyphase Transmission.—HANCHETT.—A discussion of the relative economy of copper for various methods of transmitting current. The discussion is based on equal watt loss and considers the various different voltages of star and mesh systems that may be equated. Eleven different cases are taken up and the results are worked out in the weight of copper necessary for each case as a percentage of the weight of copper necessary for single-phase transmission for the same watt loss over the same distance.—*Amer. Elec.*, November.

Copper and Aluminium Wires.—A reprint of a table published by the General Electric Co., of Berlin, for making a comparison of copper and aluminium wires for 25 different sizes. The cross-section, the resistance per 1000 meter at 15° C., the number of the single wires, the diameter of the single wires, the whole diameter, and the weight per 1000 meters in kg are given for both copper and aluminium wires and cables. The specific resistance of aluminium is taken as 0.02874 ohm per 1-m and 1-sq.mm at 15° C.—*Elek. Zeit.* and *Elek. Anz.*, Oct. 19.

Interior Wiring.—KNOX.—A continuation of a series of articles under this heading, taking up in this installment the subject of cut-out cabinets.—*Amer Elec.*, November.

ELECTRO-PHYSICS AND MAGNETISM.

Thermo E. M. Fs. of Lead-Bismuth Alloys.—SPADAVECCHIA.—Tables published by him of the thermo e. m. fs. and resistances of alloys show some interesting particulars of the behavior of lead-bismuth alloys in a magnetic field. If such an alloy is coupled with copper and introduced into a magnetic field of a few thousand units, its thermoelectric force and resistance change in the same sense, the change increasing with the magnetic field, but not proportionally. The sign of both of these changes depends upon the amount of lead in the alloy, and, as the amount is increased, the changes are alternately positive and negative.—*Nuovo Cimento*, September; abstracted in Lond. *Elec.*, Oct. 20.

Slow Discharge of Leyden Jars.—DELL.—To discharge Leyden jars gradually he places the Geissler tube or other device through which the discharge is to take place, between the outer coatings of two Leyden jars; between the two knobs connected to the inner coating, a piece of cardboard covered with tinfoil on both sides (both coatings being connected together) is hung like a pendulum, and is started to oscillate; it will touch the two knobs alternately in rapid succession and at each oscillation there will be a small discharge through the tube.—*Elec. Rev.*, Oct. 18.

Cathode Rays.—ROLLINS.—A short article confirming the statement of Lodge that the rays are best when the anode is the target which is struck by the rays.—*Elec. Rev.*, Oct. 25.

REFERENCES.

Thermo Electricity.—LIEBNOW.—A long French abstract of the article noticed in the Digest July 27.—*L'Eclairage Elec.*, Sept. 23.

An English abstract with an outline of his analytical theory and some of the formulas.—*Science Abstracts*, October.

Electrolytic Conduction of Solids at High Temperatures.—NERNST.—A long French abstract of his German Electrochemical Society paper noticed in the Digest Aug. 12.—*L'Eclairage Elec.*, Oct. 14.

Confirming Ampere's Hypothesis.—NIKOLAIEVE.—The French Academy paper, with illustrations, noticed in the Digest Nov. 4.—*L'Eclairage Elec.*, Oct. 14.

Volta.—A short historical article on Volta's discovery of the electric pile, with a reprint of a letter of Volta in which he mentions the discovery of the first form of secondary batteries by Ritter.—*Lond. Elec.*, Oct. 20.

Interference of Cathode Rays.—JAUMANN.—A long, illustrated French abstract of the article noticed in the Digest July 1.—*L'Eclairage Elec.*, Oct. 14.

Cathode Rays.—RIECKE.—An account of an experimental and analytical investigation of the mechanical reaction of cathode rays upon the surface of the cathode.—*Wied. Ann.*, Dec., '98; a long French abstract in *L'Eclairage Elec.*, Oct. 14.

Pressure of Radiation.—DONLE.—An abstract of the article noticed in the Digest July 22.—*L'Eclairage Elec.*, Sept. 30; *Science Abstracts*, October.

Nickel Steel Magnets.—DUMAS.—A French Academy paper on the magnetic transformation points of nickel steel.—*L'Eclairage Elec.*, July 29.

ELECTRO-CHEMISTRY AND BATTERIES.

Recent Developments in the Theory of the Galvanic Cell.—LE BLANC.—A good brief summary. The fundamental question is: If a cell is on closed circuit, where is the energy expended, where and what is the source of potential difference, and what kind of energy is it that is transformed? There are two ways in which this question is treated, the first of which is based on thermodynamics; three cases should be distinguished: In some cells, as in the Daniell, the whole chemical energy at the electrodes is converted into electrical energy and in such cases the e. m. f. can be calculated from the thermochemical data; in other cells only a part of the energy is converted into electrical energy, the rest appearing as heat; this is the case in most cells; in still others, the electrical energy produced is greater than the chemical, the balance coming from the free heat of the cell or its surroundings. In all these cases there is a distinct relation between the electrical energy produced, the chemical energy expended, and the temperature coefficient of the e. m. f. of the cell; if two of these values are known, the third can be calculated. The second way of treating this question is based on the newer theory of the cell, which, however, agrees with the thermodynamical theory; in this all the electric phenomena in a cell containing dilute solutions are considered to be the results of simple motions of the ions. This theory is based on that of Vant Hoff that the laws of pressure in gases apply also to the osmotic pressure in solutions, and also on the hypothesis of Arrhenius that in solutions of electrolytes a certain percentage of the molecules of the dissolved material are dissociated into ions or atoms charged with equal but opposite quantities of static electricity according to the law of Faraday. In connection with the phenomena at the contact surface of the electrode and electrolyte, Nernst has introduced the term "tension or pressure of solution," and assumes that a metal suspended in water tends to be dissolved so as to send out ions or moving atoms with a certain charge of positive electricity. If, for instance, a silver electrode is in an aqueous solution of a silver salt, the tension of solution of the electrode (which in this case is assumed to be greater than the osmotic pressure of the silver ions in the solution) dissolves positive silver ions which pass from the electrode into the solution, the electrode becoming negatively electrified; the following forces then act: The electrostatic forces caused by the opposite quantities of free electricity on the electrode and the ions, and the osmotic forces due to the osmotic pressure of the dissociated ions of the dissolved salt; these forces are opposed, and, if equal, there is equilibrium. In this way Nernst developed a formula for the difference of potential between an electrode and a solution; another for the e. m. f. of a cell formed of two solutions of the same electrolyte though of different concentrations, identical unpolarized electrodes being used; this formula agrees well with numerous measurements.—*Rev. Gen. des Sc.*, Oct. 15.

Non-Aqueous Solutions.—KAHLENBERG.—An abstract of a paper read before the Amer. Assn. Adv. Sc. on the electrolytic deposition of metals from non-aqueous solutions, and the validity of Faraday's law in such solutions. Experiments with silver nitrate dissolved in pyridin, nitro-benzene, anilin, bensonitril and acetone, and of some other salts in pyridin, show that Faraday's law holds good in these solvents. From a solution of lead nitrate in pyridin the lead is deposited in bright crystals at the negative pole, while there is no deposit at the positive pole. Silver forms a very dense deposit from solutions of the nitrate in anilin. These facts may have some industrial value.—*Science*, Oct. 27.

E. C. FRANKLIN.—A very brief abstract of another paper on a similar subject read before the same society. He gives an account of a continuation of his researches on the electric conductivity of liquid ammonia solutions and describes an apparatus for purifying the liquid ammonia, particularly freeing it from water. The electric conductivity of purified liquid ammonia was found to be exceedingly small, not more than one-fourth that of "purified water" (a rather vague term, as the resistivity of water varies with the degree of purity). Many conductivity curves were drawn, which resemble more or less those of aqueous solutions. The influence of temperature was also investigated, the conductivity increasing with the temperature to a maximum and then decreasing.—*Science*, Oct. 22.

The Electrolysis of Water.—FRANKLIN.—A description of apparatus designed and built at the physical laboratory of Lehigh University for the commercial production of oxygen and hydrogen by

the electrolytic decomposition of water. The apparatus consists of cast-iron frames separated by hard rubber diaphragms provided with inclined screens to prevent the mixing of the oxygen and hydrogen set free at opposite sides of the same cell. The results obtained with this apparatus showed that a reasonably high current density could be used without reducing the efficiency below 40 per cent., the efficiency being the ratio of the energy delivered to the apparatus to the latent head of combination of components set free. The generator is said to be entirely satisfactory in every particular. There is no corrosion of the electrodes and the hard rubber withstands the action of the caustic soda perfectly. The oxygen and hydrogen may be produced more cheaply by means of this generator than by any other. Purity of 99 9-10 per cent. may be obtained, the impurity being hydrogen in the oxygen or vice versa. The cost of production of pure oxygen is given as 1 cent per cu.ft., counting hydrogen as of no value and rating the electrical power at 2 cents per kw-hour.—*Amer. Elec.,* November.

Electrolytic Disinfecting at Havana.—Some illustrations, with a brief reference, concerning the plant which was erected in Havana for disinfecting by means of electrozone; the Woolf process, which was tried some years ago at Brewsters, N. Y., is used, and it is claimed to give excellent results. There are two engines of 250-hp each, and four dynamos of 4500 amperes each, and eight electrolyzing vats. The liquid has been used for disinfecting the streets, the sewage and the harbor since July. The cost of general disinfecting is said to be only 50 cents a thousand gallons. No further technical information is given.—*Elec. Rev.,* Oct. 25.

REFERENCES.

Conductivity and Concentration of Electrolytes.—MUELLER.—An account of some recent researches of Ostwald, Bredig, Kohlrausch and Barmwater, concerning the dependency of the conductivity of dilute solutions on the concentration.—*L'Electrochimie,* No. 4, p. 58; abstracted in *Elektrochem. Zeit.,* September.

Hydrogen Generation.—COEHN.—A long French abstract of his German Electrochemical Society paper noticed in the Digest Aug. 26 and Sept. 2.—*L'Eclairage Elec.,* Oct. 14.

Electrochemical Industry.—LUNGE.—A long abstract of the paper on the future of water power and electrolytic alkali processes, noticed in the Digest Nov. 4.—Lond. *Elec. Rev.,* Oct. 20.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Galvanometer for Submarine Telegraphy.—A short article on recent improvements and present practice, referring chiefly to instruments to be used on shipboard. The moving coil principle is preferred; the Sullivan instrument with a camel-hair brush damping is now used on nearly all cable ships; it is used also for speaking purposes and may soon be introduced on English battleships; the camel-hair brush is placed against the phosphor-bronze strip on which the coil is suspended; an improved form has proved to be very satisfactory on one of the Atlantic cables 3000 miles long.—Lond. *Elec.,* Oct. 20.

New Unit of Power.—DREXLER.—A short article in which he proposes to introduce a new unit of 100 kilogram meters (probably meaning per second) in place of the horse power; as a name for it he suggests calling it the unit of effect.—*Zeit. fuer Elek.,* Oct. 15.

REFERENCES.

Caldwell Interrupter.—SIMON.—An abstract of the article noticed in the Digest July 15. This formula for the time of interruption as dependent upon the e. m. f., the inductance of the circuit, the anode surface and the specific resistance of transition, is reprinted.—*Science Abstracts,* October.

A New Resistance Material.—HARAEUS.—A long French abstract of his German Electrochemical Society paper noticed in the Digest Aug. 26.—*L'Eclairage Elec.,* Oct. 14.

The Reichsanstalt.—The report for the year ending Jan. 31, 1899. (See also Digest Sept. 23, 30.)—*Zeit. f. Instrum.,* July, August; noticed briefly in Lond. *Elec.,* Oct. 20.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Transmission of Pictures.—A note stating that Szczepanik, who two years ago claimed to have invented a new apparatus for the transmission of pictures, now repeats this claim, but it is suggested that it should be treated with the utmost scepticism, his patent showing nothing more than the old selenium cell idea in a dress of no very startling novelty.—Lond. *Elec.,* Oct. 20.

REFERENCES.

American Telephone Practice.—MILLER.—A continuation of the series of articles under this heading (Digest, July 22) taking up in this installment the subject of commercial Wheatstone bridges.—*Amer. Elec.,* November.

All British Cable.—The full report of the Postmaster General of South Australia on the cable question, which was repeatedly referred to in the Digest.—Lond. *Elec.,* Oct. 20.

MISCELLANEOUS.

Magnalium.—GREMPE.—An article on this new alloy of aluminium and magnesium referred to in the Digest Oct. 21. The German Magnalium Co. is about to introduce it, but has not yet published numerical data. Magnalium is claimed to have all the advantages of aluminium, but can also be worked with cutting tools, stamped, rolled, curled, polished and does not oxydize if exposed to air; it can be welded with metals, such as iron, under pressure. No particulars are given concerning its electric properties.—*Centr. Zeit. fuer Optik u. Mech.,* Oct. 1.

REFERENCES.

Stassano Process for Electrically Producing Iron and Steel.—DEMENGE.—A description of the Stassano process which was referred to in the Digest Sept. 30 and Oct. 28. The electric furnace is illustrated and an itemized estimate of the energy consumed by the process is given, the final data being the same as that in the Digest Sept. 30.—*Rev. Gen. des Sc.,* Oct. 15.

Electric Welding and Soldering.—ENZLER.—The first part of a paper, in which some methods of electric welding are described and the advantages of the electric method are discussed.—*Elek. Anz.,* Oct. 19.

Effect of Currents on the Human Body.—KATH.—A long French abstract of his paper noticed in the Digest Aug. 5 and Sept. 23.—*L'Eclairage Elec.,* Oct. 14.

Assistance to Those Injured by Electric Currents.—A set of rules adopted by the Union of German Electrical Engineers, with illustrations showing how to bring about artificial respiration.—*Elek. Zeit.,* Oct. 19.

The National Export Exposition in Philadelphia.—An illustrated description of the exposition in general and of the electrical exhibits in it.—*Amer. Elec.,* November.

Society of Electrical Engineers of Switzerland.—An account of the proceedings of the annual meeting held at Burgdorf, Sept. 30 to Oct. 2. The president is Prof. Wyssling. A report was presented from the special committee appointed to inspect high pressure installations. In the cantons of Freiburg and Wallis this inspection by this committee has been made obligatory by the government.—*Schweiz. Blaetter fuer Elek.,* Oct. 8.

New Books.

HEAT AND HEAT ENGINES. A Study of the Principles which Underlie the Mechanical Engineering of a Power Plant. By Frederick Remsen Hutton, E.M., Ph.D. New York: John Wiley & Sons. 553 pages, 198 illustrations. Price, $5.00.

With the excellent treatises already available on thermodynamics and heat engines, it might at first sight appear that there was small reason for an additional book on these subjects. With the book in hand, however, the mode of treatment and the standpoint from which departure is taken are both found quite different from those of previously existing books on the same subjects, and it is these features which furnish reason for the preparation of the work. To quote from the author's preface the book discusses "the energy resident in fuels, and the methods of its liberation as heat for power purposes; the transfer of such heat to convenient media whereby it can be used in heat engines; the laws and properties of such media, and the design of cylinders of the necessary volume to give a desired mechanical effect or horse-power."

In the development of the subject the author has avoided the use of the calculus and the higher mathematics in general, as well as the deductive mode of reasoning which mathematics so especially favors. The attempt is made to present the facts as shown by experience, and to trace their immediate relation to the problem of design and operation, rather than to discuss their general relations on the higher plane of deductive mathematical reasoning. The author is naturally handicapped by this mode of treating thermodynamics, and necessarily many omissions in the logical and rigid development of the

subject occur. The author is well aware of these results of the limitations under which he has chosen to work, and in his preface expresses the hope that the student will turn from this work to further and exhaustive research in the higher fields.

The book is divided into twenty-three chapters treating on the subjects mentioned above and with chapters on compressed air engines; hot air engines; internal combustion engines; vapor engines; mechanical refrigeration and the injector.

An illustration of the difficulties met with in treating the subject without calculus is shown in Section 124, where the attempt is made to define entropy. Here, of necessity, both the concepts and the terminology of calculus are introduced in the explanation of the subject. No one unacquainted with this branch of mathematics could gain any idea of entropy from the treatment given, simply because fundamentally it is a subject requiring the concepts of the calculus for its discussion. Exception might properly be taken to one point in this section wherein it seems to be assumed that absolute or thermodynamic temperature may exist independently of its property as the reciprocal of an integrating factor of the general heat differential. As a matter of fact, the definition of thermodynamic temperature by Carnot's principle makes of its reciprocal an integrating factor, and the most fundamental aspect of this temperature is as the reciprocal of an integrating factor for the general heat differential.

In the chapters on the steam engine a good discussion is given of the various causes which limit or reduce economy, and of the means available for preventing or reducing these losses. In the chapter on the thermal analysis of heat engines an excellent presentation is given of Hirn's analysis with a form for its practical application. A discussion is also given of the application of the temperature entropy diagram to the thermal analysis of heat engines, following in the lines of Boulvin and others.

A 400-LB. ELECTRIC VEHICLE.

The chapters on internal combustion and vapor engines are timely and should meet the needs of the increasing numbers of those who are turning their attention to these types of engine. Refrigeration and refrigerating machines are also clearly though briefly treated in the final chapters. The book closes with a brief bibliography of the subject, which is as acceptable as it is unusual in modern technical books. This method of giving in an appendix a brief list of the more important works on the subject is one which may be warmly commended to all writers on engineering subjects.

The book is printed and bound in the usual excellent style of the publishers, and is provided with an abundance of diagrams and cuts, most of which were apparently prepared especially for this work.

BOOK RECEIVED.

MONOPOLIES AND THE PEOPLE. By Charles Whiting Baker, C. E. Third Edition, Revised and Enlarged. New York, G. P. Putnam's Sons. 368 pages. Price, $1.50.

Chapman Electric Vehicle.

The illustration shown above represents an electric vehicle designed by Mr. W. H. Chapman, electrician of the Belknap Motor Company, Portland, Me. The total weight of the vehicle is 400 pounds. Equipped with 18 cells of "Syracuse" storage battery, it has a capacity of 20 miles on one charge on a smooth and level road and carrying two persons. The maximum speed is 12 miles per hour. There are two motors each of ½-hp, and a controller connects these to operate as generators going down hill, which provides an excellent coasting brake. The frame is of bicycle construction. The vehicle illustrated has been in use continuously since Aug. 5 last for pleasure riding and running about as with a bicycle. The frame is made of two ladies' bicycle frames with a tie frame in between, which gives flexibility and allows each side to adjust itself independent of the road surface. Three full-grown persons have been carried by the vehicle, giving a total weight of over 800 pounds.

Novel Impulse Wheel Generating Plant.

There is at present in successful operation in the pumping station of the City of Columbus, Ohio, a plant installed by the American Impulse Water Wheel Company, of New York, which is unique in character, and presents a number of interesting engineering features.

The director of public improvements, finding that the pumping capacity of the station was greater than the city's needs required, cast about him for some means of utilizing this surplus capacity, and hit upon the idea of using the surplus water that the pumps were capable of supplying, to drive water wheels direct connected to dynamos, the current thus generated being used for supplying light to the surrounding district by means of arc lamps.

Specifications were accordingly prepared and submitted to the leading water wheel manufacturers, with the result that the plan proposed by the American Impulse Water Wheel Company was accepted. The specifications were very rigid in their requirements with regard to both efficiency at all loads and to speed governing under sudden and great changes of load. The difficulty of the problem was also much enhanced by reason of the very limited space available for the machines and piping, and by the high speed required for direct connection to the Western Electric Company's 100-light arc dynamo, which was the dynamo selected by the engineer in charge. This speed, 650 r. p. m., necessitated the use of impulse wheels only 18 inches in diameter, and in order to obtain 110-hp from each unit, 18 nozzles were required. These were arranged with 6 runners, 3 nozzles to each runner, since a larger number of nozzles per runner would have reduced the efficiency below the guarantee.

The use of contracting nozzles to keep up the efficiency at light loads was prohibited by the great cost and complication of so large a number of contracting nozzles. Ordinary butterfly valves were accordingly used, and the cam mechanism for operating these valves, shown in Fig. 1, arranged to actuate them one after the other instead of all together as had previously been common practice. As a result of this ingenious arrangement, all the valves in operation, except one, would be wide open and working, therefore, at their maximum efficiency, and thus the low efficiency of a partly closed butterfly valve would have an almost inappreciable effect in lowering the total jet efficiency of the machine; and at six values of the load, when a valve had just completely closed, would have no such effect at all.

The rigid requirements with regard to efficiency having been thus complied with, the problem of speed governing was next attacked. The small diameter of the runners, rendered necessary by the high speed, so far reduced their monmentum that it was necessary to add a heavy flywheel in order to keep the variations of speed within the guaranteed limits. The high speed also prohibited the use of the ordinary cast iron flywheel. The wheel was accordingly made with a steel rim shrunk on to a cast iron web. The governor is the ordinary mechanical relay actuating six cams as shown in Fig. 1, the connection between the cam shaft and the governor being by gear and pinion.

The water chambers were cast in two pieces shown in Fig. 1, the nozzles being bolted on so as to come in exactly the right position with reference to the runners. This large casting rested on the cast iron base and was bolted to it. The casing was made of riveted boiler iron in two parts, the upper half being provided with eyebolts for lifting. The details of the piping, receiver, etc., are clearly enough shown in the accompanying illustrations.

The fact that this plant has now been running for over twelve

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months without trouble of any kind and to the entire satisfaction of the engineer in charge, reflects great credit upon the manufacturers of the apparatus, and upon their consulting engineer, Mr. Thorburn Reid, to whom was entrusted the task of meeting and overcoming the difficulties presented by this new departure in water-wheel engineering.

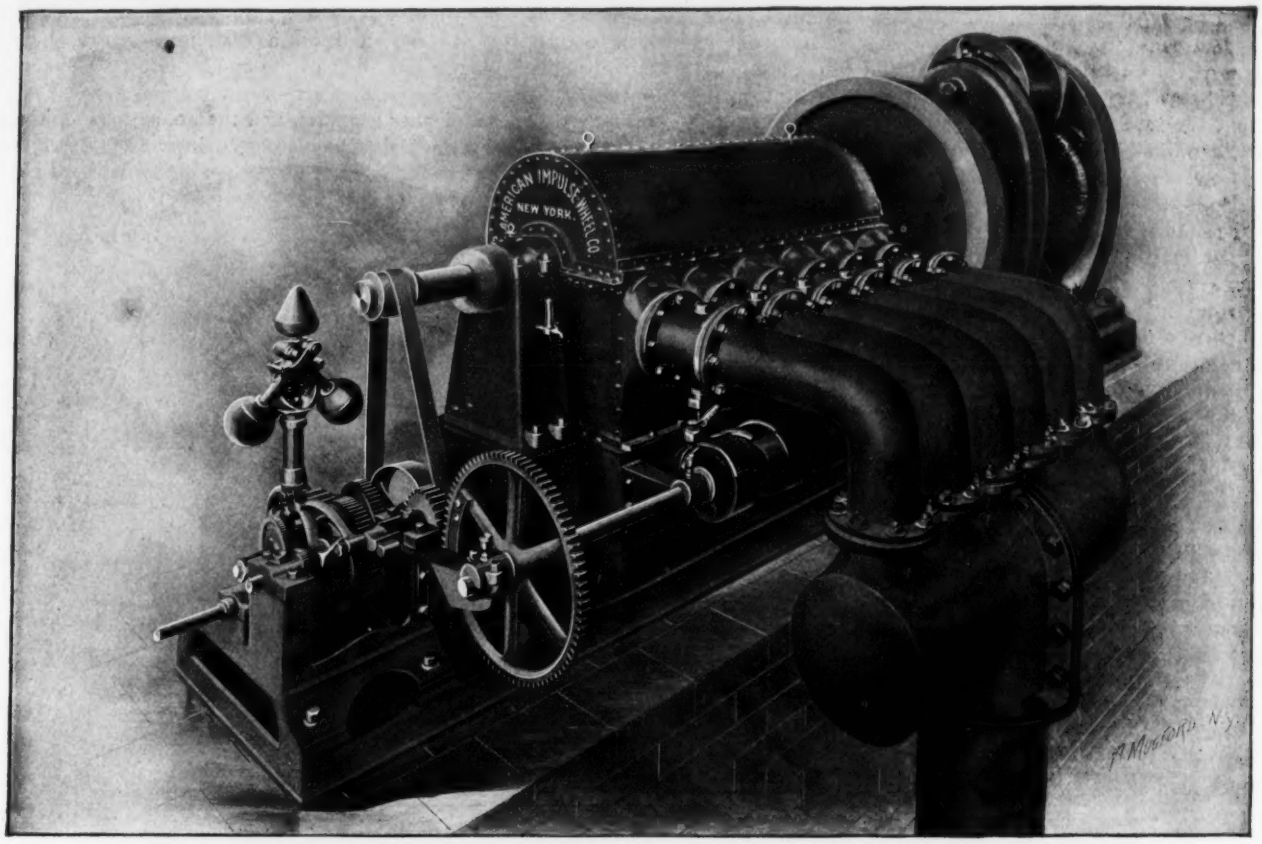


FIG. 1.—CAM MECHANISM FOR OPERATING THE VALVES.

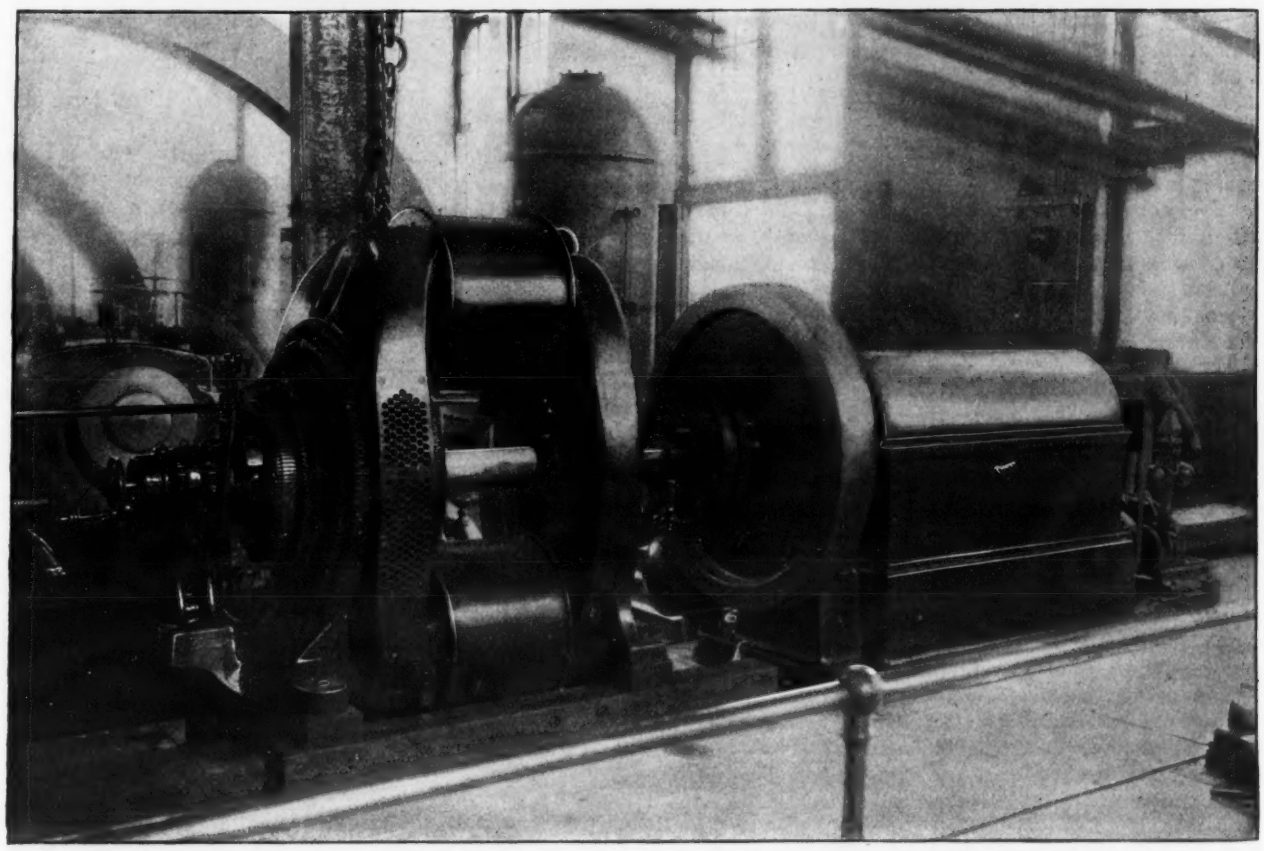


FIG. 2.—GENERATOR DIRECT CONNECTED TO WHEEL.

A Large Submarine Telephone Cable.

What is claimed to be the longest submarine telephone cable of its size in the world was laid last week across the Straits of Mackinaw, from Mackinaw City to St. Ignace, by the Michigan Telephone Company—the Michigan end of the Erie Telephone

Company. The cable renders possible telephonic communication between the upper and lower peninsula of the state. This heretofore has been impossible, with the single exception that Menominee, which is in the Upper Peninsula, just across the border from Wisconsin, has been reached by a very circuitous route around the southern end of Lake Michigan, via Chicago and Milwaukee. The great copper country of the north, however, has been out of the telephonic reach of Grand Rapids, Detroit and other points in the lower peninsula, and this undoubtedly has had something to do with the fact that Chicago and Milwaukee have virtually controlled the trade in various lines in Northern Michigan.

The cable is one of twenty "Simplex" strands, bound in tape and jute and armored with No. 6 iron wires. Two of these conductors are larger than the others, and form the core; their conductivity is about that of a No. 8 wire. The other nine pairs—for the circuits are full metallic, and the conductors will be used in pairs—are equal in sectional area of copper to No. 12 wires. The outside diameter of the cable is about 2½ inches. The cable terminals are in cable boxes mounted on poles on either shore of the straits, and the whole length is 5 miles and 175 feet. A representative of the company makes the statement that it cost $35,000, delivered at Mackinaw City.

After a week of preparation which included the work of splicing the several lengths together, the cable was loaded upon a barge, in tow of two tugs. A crew of twenty men was in charge of the work upon the barge, and the whole undertaking was under the personal supervision of Louis Hall, of Detroit, state superintendent of construction for the Michigan Telephone Company. The actual work of planting below the waters the great rope of insulated copper conductors was commenced Oct. 26, and the trip across was made in a few hours. The greatest depth of water on the line surveyed for the cable was 256 feet. At 5 o'clock Thursday afternoon communication by telephone was had across the Straits of Mackinaw for the first time in history. A Western Union cable has been in operation at this point for some time, but that is all.

The expense of laying the new cable was very great. For more than a week prior to the day it was placed in the water the company was put to an expense of $80 per day for the tugs, and the laborers in the crew received $5 per day. They demanded this amount, and it was found more expedient to give it to them than to delay the work for the purpose of getting others to take their places. Of course, the salaries of the experts were much larger.

Six of the ten metallic circuits will be put into use as soon as the land lines on either side of the strait are completed. Some lines already reach Mackinaw, but others are being constructed, and the lines in the Upper Peninsula are being pushed forward with wonderful rapidity. Between Soo City and Marquette there are now working five crews of fifty men each. These crews have their camping outfits, special cars and commissary departments. Another large crew is completing the lines this side of Mackinaw City. One of the six metallic circuits to be put into immediate use is for a local line connecting Mackinaw City and St. Ignace. The other four of the ten are a reserve to provide against possible needs in future.

A Sturtevant Steel Plate Electric Fan.

For the handling of air for the purposes of ventilation, mechanical draft and the like, the adaptability of the electric fan has become more evident as electricity has become more generally adopted as a motive power. The electric fan to-day stands as much as an independent type as does the pulley fan or steam fan.

Years ago when it first became the custom of driving a fan by direct connected engine, the B. F. Sturtevant Company, of Boston, Mass., entered upon the design and construction of a special line of engines particularly adapted for this work.

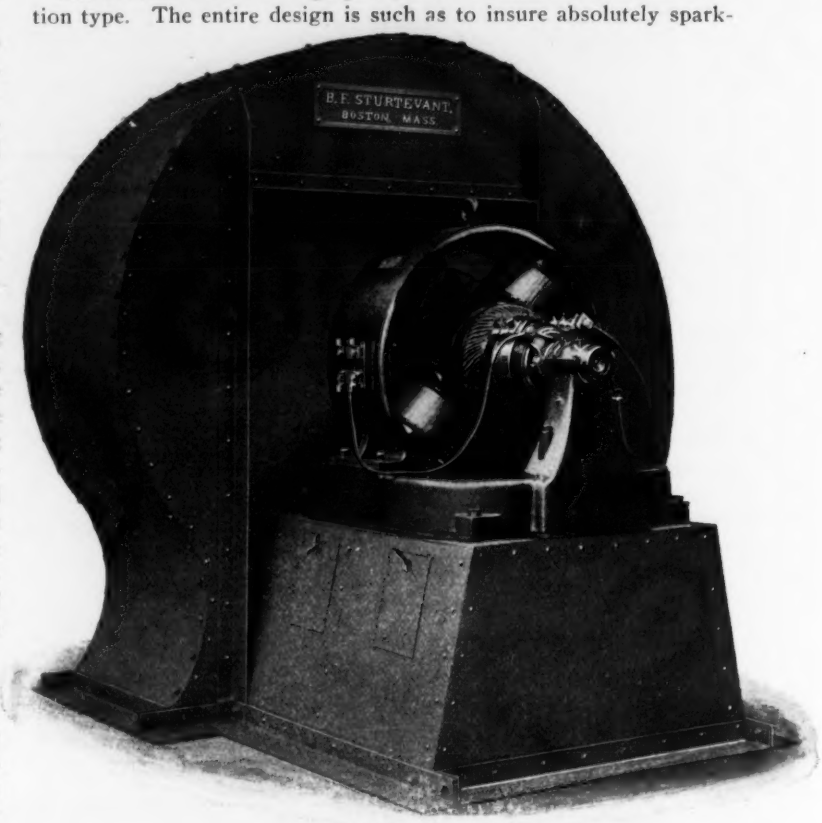
Now that electricity has become such a general means of driving machinery, the same company has taken the same course regarding the manufacture of motors and generators. The illustration herewith shows one of the recent developments in the form of an electric fan, having a direct attached motor of standard form. The fan itself is of the ordinary steel plate construction, in this case arranged to discharge downward at an angle.

The motor, which is complete in itself, is supported upon a steel plate base attached to the side of the fan. The field ring and pole pieces of the motor are of cast steel, to which are attached cast iron shoes.

Special attention to the conditions of continuous operation has been given to the design of this motor, and ventilating ducts have been provided within the core of the armature, so that a circulation of air is secured whenever the armature is in operation.

The barrel wound type of armature is employed, it being built up of laminated, slotted discs clamped between brass rings. The discs themselves are mounted on a cast iron spider, having a hub projection for the reception of the commutator. The segments of the latter are of pure rolled or drawn copper.

The brushes are of fiber graphite, and the holders are of the reaction type. The entire design is such as to insure absolutely spark-



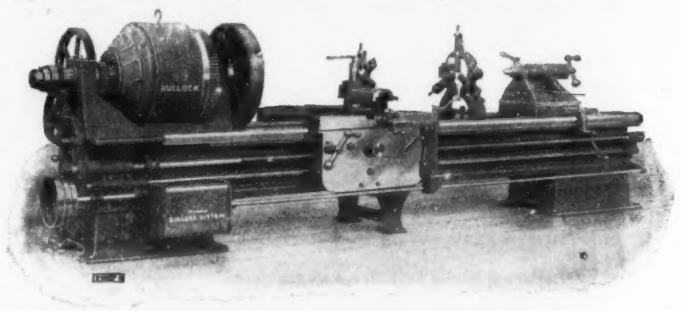
STURTEVANT STEEL PLATE ELECTRIC FAN.

less operation at all changes of load from no load to 25 per cent. overload, while the temperature rise after 10 hours' continuous run is limited to 90 deg. F. The bearings are of the ball and socket type with ring oilers. Fans of this type are built in all sizes, with motors ranging from small output up to 125-hp.

Electrically Driven Lathe.

A 28-inch swing screw-cutting engine lathe, driven by a "Bullock" type "N" motor, is shown in the accompanying illustration. As will be seen, the motor is placed directly on the spindle in the head stock, taking the place of the cone pulleys. The armature spider is built directly upon the hollow spindle of the lathe.

By means of a new system of variable speed control, the motor



ELECTRICALLY DRIVEN 28-INCH LATHE.

is given a greater range of speed, without loss of torque, than is ordinarily given by the cone pulley, having 16 speeds in either direction including the back gear. The controller is placed upon the leg of the lathe directly under the head stock, and is operated by a splined shaft running along the bed of the lathe, and a handle which travels with the carriage. The slowest speed is 60 and the highest about 250 revolutions.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was one of greater strength and buoyancy until the upward course of the market was sharply checked by the bank return which showed how under the enormous demands of business activity the reserve had melted away to nothing, or at least had got below the 25 per cent. ratio to liability. As a result industrial shares in which speculation had again become lively, were the first to suffer, and some of them got a very bad black eye. Other securities, however, were firm, especially such as have stable value and are feeling the full tide of general prosperity. During the week, Western Union was dealt in to the extent of 5917 shares, rising 1½ to 89½. General Electric was very dull and inert, but strong, closing at 122 on 1625 shares. Brooklyn Rapid Transit had one more lively week, 435,765 shares being sold, and went up 2¼ to 88¼. Manhattan Elevated was stronger on 108,399 shares and closed 2¼ higher at 110½. Metropolitan Street Railway was off 1 to 197 on 10,936 shares. In Boston, American Bell Telephone despite the alarmist talk of a big new opposition, was firm around 368-370; Erie, 116-117; Michigan, 106-108; New England, 151-153; Mexican, 3¼-3⅜; West End Railroad, 93½; Westinghouse Electric, 46; Boston Eelevated, 106½-107. In Chicago, West Chicago Railroad was quoted at 119; Union Traction, 30; Metropolitan Elev. preferred, 73. South Side Elevated, 99. In Philadelphia, the market was dull, Phila. Traction closing at 95⅞-96⅝; Union Traction, 38½; Electric Company of America, 15-15½; Penn. Mfg. Co., 35¾-25⅞; Electric Storage Battery, 124-124½, common and equal prices for preferred; Penn. Electric Vehicle Co., 11-11⅛ common; 4½ preferred. National Electric Co., 11-11⅛. In the New York outside market, Electric Axle Light & Power was quoted 4¾-5; Electric Boat, 18-22 common; 35-45 preferred; Electric Vehicle, common 72; preferred, 95. New York Elec. Veh. Trans., 16-17; New England, 7-7¾; Illinois, 3⅝-4; General Elec. Automobile, 17-24; General Carriage Co., 20-30; Otis Elevator, 29½-31, common; 92½-94 preferred.

DIVIDENDS.—The West Chicago Street Railway Company has declared a quarterly dividend of 1½ per cent., payable Nov. 15. The Duquesne Traction Company, of Pittsburg, has just declared the regular semi-annual dividend of 2 per cent., or $1 per share. The Ashton Valve Company has declared the regular quarterly dividend of 1½ per cent. and an extra dividend of 1 per cent., payable Nov. 15. The directors of the National Gramophone Corporation have declared the regular 1 per cent. monthly dividend. The Quincy & Boston Street Railway Company is paying a regular semi-annual dividend of $3.50. The directors of the New England Telephone & Telegraph Company have declared the regular quarterly dividend of $1.50 per share, payable Nov. 15.

A WATER POWER PLANT FOR JERSEY.—Eighteen acres of land at Mount Holly, N. J., including valuable water rights, have been transferred to the American Investment Company by Mrs. Richard C. Shreve. The company will replace the present mill dam with a substantial stone dam capable of impounding a big head of water, which will overflow the meadows in all directions. The adjoining property which will be overflowed has been purchased. Sufficient power will be obtained to operate a big electrical power house, which is to be located beside the dam. The power generated will be used for all purposes and transmitted to Haddonfield, Merchantville, and Moorestown,

ERIE TELEPHONE.—No change has been made in the capital stock of the Erie Telephone & Telegraph Company since it was originally organized in 1883, when it was fixed at $5,000,000. Over $8,000,000 of money has, however, been employed in improving the property and increasing the assets of the company. A net gain of at least 45,000 subscribers or 75 per cent. will be the record of 1899 with a corresponding increase of toll line earnings; and 50,000 new subscribers for each of the years of 1900 and 1901 is President Glidden's prediction.

METROPOLITAN EARNINGS.—The gross earnings of the Metropolitan Street Railway Company for October were $1,301,726, an increase of $50,079.

Commercial Intelligence.

THE WEEK IN TRADE has not varied in any particular manner from its predecessors of the fall season, but finds practically all branches of trade and industry fully occupied, and a great deal of overtime work being done. In some respects, it might be counted an improvement if the overtime could be dispensed with, and the work thus done spread out over a longer period of production under normal conditions, but the temptation is great to drive a plant at its highest. The country will probably yield less to such impulses as it gets older, and realizes more fully the danger of gigantic oscillations between over production and under production. Just now many concerns are a year behind their orders. Mention was made last week in our hearing of a 10-kw unit which could not be supplied to the purchaser by either of two concerns under 120 days; and there is a great deal of electrical work tied up because the material for finishing it cannot be secured. In the meantime it is satisfactory to note that as we predicted, copper is in freer supply and weaker again, having slid down to 17 cents. Prices of pig iron for early deliveries are still advancing, but a great part of the demand has protected itself by contracts running far into next year, including purchases of 50,000 tons Bessemer last week at $23.50, and billets are quoted at $39.50 for spot but $35 for next year. Anthracite pig is also quoted at $24.50 for early delivery, and local coke at Chicago. No finished products have advanced during the past week excepting refined bars which the eastern association has put up $1 per ton. More weakness appears in some lines, of which the works have not orders running far ahead. But it is claimed that 1,800,000 tons of rails, 80 per cent. of the entire capacity, has been sold for next year. Tin is weaker at 30.50 cents, while spelter is offered at 4.85 cents. Clearing House returns for the week ending Oct. 28 showed a gain of 33.7 per cent. over 1898 and of 50.7 over 1897. Dun's, speaking of the general situation, points out that failures have never been smaller than in October in any month excepting May, June and July of this year, since monthly records began six years ago. Trading failures have never been as small in any other month of any year. Manufacturing failures were never smaller in any month save one prior to this year, and yet have been smaller in six of the nine months of 1899, in January and in May-September, inclusive. The remarkable decrease in number and size of small failures, Dun's says, calls for especial notice. Along special lines Bradstreet's says that active features are textile trades, iron and steel, machinery, jewelry, coal mining and coke production. Manufacturers of paper are active, owing to brisk demand, short supplies, and advancing prices. The coal trade is in very good condition, the only complaint, in fact, being the lack of transportation facilities. A similar condition is noted in the coke industry, where a scarcity of cars militates against even more pronounced activity.

AUTOMOBILE COMBINES.—A certificate has been filed with the secretary of the state of Delaware for the incorporation of the Anglo-American Vehicle Company, with an authorized capital of $75,000,000. This company proposes to combine into one immense concern all the leading English and American automobile manufacturers, and its headquarters will be in New York. The incorporators are H. B. Twyford, of Wyndley Grange, England; Ernest Martin, of New York, and James Virdin, of Dover. Either this or another combine has been on foot this week at the Waldorf-Astoria. Messrs. Homer W. Hedge, secretary of the Automobile Club, and E. Kempshall, of Boston, are understood to be engineering it, and such names as Studebaker, Riker and others are glibly mentioned as likely to be interested. Mr. Hedge is quoted as saying: "It is proposed to form a corporation with a capital of $200,000,000, which will control the horseless carriage and its rubber tires, and really everything connected with it. The corporation probably will be formed under the laws of New Jersey, as it can be done there much better than elsewhere. There have been rumors of a trust already formed with a capital of $75,000,000, but we cannot find out who is in it. Whoever they are they will be brought into the larger concern. We will control the manufacture of electric, gasoline and petroleum automobiles and all kinds and conditions of tires. We practically will have the control of all parts of the vehicles. The two chief firms that are not with us at present are the Goodrich Company and that of which Mr. Kempshall is the head. As they are two of the chief ones in the country—Mr. Kempshall's being the best of all, I think—they will be brought in, too."

SOUTHWEST MISSOURI ELECTRIC RAILWAY COMPANY, Webb City, Mo., of which Mr. A. H. Rogers, of Joplin, Mo., is president, is making a variety of improvement and additions to its property. At Webb City they are putting up a new combination car house and repair shop, 143 by 200 feet, of stone and brick. In the power house there, they are installing a new unit consisting of a three-phase generator of the revolving field type of 750-kw, supplied by the General Electric Company, and direct connected to a compound condensing Cooper Corliss en-

gine, cylinders 26 by 48 and 52 by 48. As part of this system, they are also constructing three substations each to contain a 250-kw rotary converter. One of these will be near Carthage, Mo., one in South Joplin, and the third at Galena, Kan. They are also replacing their tubular boilers by three Cahall horizontal water-tube boilers, with a rated capacity of 500-hp each, and a working pressure of 150 pounds. They have bought from the Worthington Company an outfit of cooling tower, fans, condensers, etc. A number of stretches of double track are being intercalated in their main line between Carterville and Galena, and for this work they are receiving from the Pennsylvania Steel Company shipments of steel rail weighing 60 pounds to the yard, in 60 foot lengths. They are also receiving from the Laclede Car Company six new cars, 42 feet in length, equipped with G. E. 57 motors on Brill trucks. They will now construct an extension from Galena, Kan., southwest to the Riceville mining district, a distance of about 2½ miles; another branch of about three miles from Prosperity to Duenweg, and a third, five to eight miles in length, from Joplin into the mining district northwest of the city.

SPRAGUE ELECTRIC COMPANY.—This concern has not after all carried out the projected alliance with the Stanley Electric Manufacturing Company, the opposition to it being rumored to come from Mackay interests. As a result of this determination arrived at last week, Mr. Henry Hine, of the Stanley Company, has ceased to act as general manager of the Sprague Co., and the duties being taken up temporarily by Mr. W. D. McQuesten are now to be discharged by Mr. Allan C. Bakewell, who has long represented important interests in the Interior Conduit and Sprague Companies, and is thoroughly familiar with the details of the business. The other officers of the Sprague Company are Messrs. John Markle, president; E. C. Platt, first vice-president; F. J. Sprague, second vice-president. The executive committee will consist of Messrs. Markle, J. E. Searles, E. C. Platt, A. B. Chandler and F. O. Briggs, the last named representing Roebling interests. It is regrettable to state that Mr. Chandler is still obliged to rest at his Vermont home, and may not be able to participate actively in affairs for some time to come. Mr. C. P. Geddes is secretary and treasurer, and Mr. D. E. Goe continues his active campaign in charge of the sales department, having issued recently a whole flight of excellent trade catalogues, etc.

NIAGARA FALLS POWER PLANT.—The contract for building the new wheel-pit of the Niagara Falls Power Company has been awarded to the National Contracting Company, of New York City. The work will commence at once, and the wheel-pit construction alone will cost nearly $1,000,000. The pit will be located on the east side of the inlet canal and will be known as wheel-pit No. 2. A power house similar to the present station will be erected over the pit. The initial installation in the pit and power house will be six turbines and six dynamos. The contracts for these machines have not yet been awarded. It is expected that the work will be completed in the spring of 1901. It will give employment to many men. The president of the National Contracting Company is General Francis V. Greene. William Young is the superintendent, and General Avery D. Andrews is the general counsel. General Andrews is the present adjutant-general of New York State, and president also of the Automobile Club of America. George B. Burbank, who was resident engineer of the Niagara Falls Power Company during the time of the construction of the tunnel, canal and first section of the wheel-pit, is also connected with the National Contracting Company as consulting engineer.

THE WIRELESS IN HONOLULU.—Telegraphic communication by Signor Marconi's wireless system is to be established between five of the Hawaiian Islands by a company of Americans. These islands have never been electrically connected. Frederick J. Cross, of the firm of Catton, Neill & Company, engineers, of Honolulu, who has been lately in this city, has closed a contract for the American company in Hawaii. Although many engineers regarded the connection of the five islands by cable as impracticable, because of coral reefs, on which a cable is soon covered with coral growth, breaks are frequent and repairs exceedingly difficult, the American company had about decided to attempt it, as the needs of telegraphic communication had grown most urgent. Then they heard of Signor Marconi's achievements, and Mr. Cross was sent to this country to view the workings of his system. He found that the Marconi system would cost much less and be more practicable in many ways than a cable. Regular telegraph business will be done by the company installing the wireless system. The distances over which communication will be established will vary from eight to sixty-one miles.

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical materials are from the port of New York, for the week ending this date: Argentine Republic, 119 cases electrical material $9274. Brazil, 106 cases electrical material $4093. Bremen, 1 case electrical material $40; 1 case electrical machinery $70. British Australia, 15 cases electrical material $3630. Barcelona, 3 cases electrical material $249. Central America, 8 cases electrical machinery $156. Cuba, 89 cases electrical material $2478; 2 cases electrical machinery $300. Dutch East Indies, 14 cases electrical material $259. Ecuador, 208 cases electrical material $1140. Havre, 211 cases electrical material $32,919; 1 case electrical machinery $26. Hamburg, 40 packages electrical machinery $1330. Japan, 67 cases electrical material $2090. Liverpool, 153 cases electrical material $17,528; 5 cases electrical machinery $100. Mexico, 210 cases electrical material $7728. Milan, 1 case electrical material $106. Peru, 21 cases electrical material $232. Santo Domingo, 31 packages electrical material $497. Southampton, 8 packages electrical material $488. Venezuela, 6 cases electrical material $149.

AMERICAN ELECTRIC CONDUITS IN GLASGOW.—The National Conduit & Cable Company, of this city, has secured, through its foreign branch in London, the contract for supplying and laying the conduits for conveying the cable for the Glasgow municipal tramways, as well as the contract for supplying the cable. All the material will be made at the company's works, at Hastings, N. Y. The contracts were awarded by the Tramways Committee of the Glasgow corporation. They call for the delivery of 100,000 feet of conduit a week for six months. Already 400,000 feet have been shipped, and the work of laying the pipe under American supervision has been begun. Other foreign contracts that the company has lately completed, or is now working on, include the Central London Railway, London United Tramways, Bristol Tramway Company and the Sheffield Tramway Company. There are now British orders on hand, Vice-President McQuaide says, for more than 15,000,000 feet of conduit, and the company's works, which have a daily capacity of 80,000 feet of conduit, are running day and night.

"DON'TS" FOR EXPORTERS.—The chorus of complaints from American Consuls that American exporters do not attend to business in the right way is reinforced in a communication from Consul J. C. Monaghan, of Chemnitz: "Don't abbreviate," he says. "Who over here is familiar with English abbreviations? Don't neglect your correspondence; it pays to answer letters promptly upon receipt. Don't have goods of a quality below samples. Packing is a very important factor. Don't pack as if you never expected to sell another bill of goods. Herein the Germans excel; and it pays. There are few things more exasperating than to wait a long time for an article and have it come unfit for use. Do what other successful nations are doing to get foreign markets." He declares that Germany has gained a commanding position in Russian trade, and that it is time for America to take a hand. The disposition of Russia toward our people is very favorable.

BRILL CARS ABROAD.—The J. G. Brill Car Company of Philadelphia is now engaged in building a large number of double-deck trolley cars for the General Traction Company of Paris, which will operate street tramways from the centre of the city to the exposition grounds in 1900. Owing to the size and weight of the cars they will be mounted upon heavy double trucks. Over 40 per cent. of the output of the Brill plant is for export. In addition to the French contract the company has one for 150 trolley cars for Lisbon, Portugal. Within the past few months the firm has shipped cars and trucks not only to several European countries, but to China, South Africa and South America. Large contracts for cars for street railways in Mexico and South American countries have been received, and will be filled within two months. Other foreign orders for car trucks are being filled for cities and tramway companies in Italy, France, and England. The Brill plant is building at present over 2600 trucks on foreign orders.

ELECTRIC TRACTION IN SPAIN.—Julius G. Lay, United States Consul-General at Barcelona, has sent a report to the state department, in which he says: "Within the last few months foreign enterprise has been the means of inaugurating electric traction in the streets of Madrid, Barcelona, Valencia, Bilbao and San Sebastian, and the lead thus taken by the principal tramway companies in the chief cities of Spain is likely to be quickly followed by others. It appears to me, therefore, that the present moment is particularly opportune for our makers of electrical plant, steam engines, boilers, rails, wire, etc., to come forward with tenders for the supply of such materials. If our manufacturers and street railway journals will send me their names and addresses I shall be glad to furnish them with the names of the chief contractors of all new companies, when they are formed for building tramway lines, and information regarding any movement toward the purchase of electrical supplies by the older ones."

STORAGE BATTERY PLANT FOR THE THIRD AVENUE RAILROAD.—It is reported that the Third Avenue Railroad Company has closed a contract with the Electric Storage Battery Company, for storage batteries having an aggregate of

about 10,000-hp, to be used in connection with the electric equipment which has recently been put into operation upon its lines. The batteries will be located at two substations and will play a very large part in the successful operation of the road. It is understood that it is the intention of the Third Avenue Railroad Company to increase very largely the battery equipment within the near future. The contract was closed with the Electric Storage Battery Company, by Mr. J. A. Elias, president; Mr. H. Hart, vice-president; Mr. John H. Robertson, superintendent, and Dr. Louis Duncan, consulting electrical engineer to the Third Avenue Railroad Company.

MANHATTAN'S THIRD RAIL.—The Manhattan Elevated Railway Company has equipped experimentally with the third rail a section of its road at Third Avenue and Eighty-ninth Street. The third rails with which all the company's lines will be equipped are now in course of delivery under the contract made some time ago, but the work of placing them has not yet begun. The statement that the contract for the electrical motor equipments had been signed more than two months ago, and that three electrical companies would each get a part of the work, is positively contradicted by officers of the Manhattan Company, who said that the big contract was still to be closed and that what electrical company would get it could not yet be stated. There is a general and pretty well confirmed understanding that it will be divided.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY report 55 orders for the month of October, the machines ranging in size from the smallest to 300-kw capacity. A repeat order was received from the Maryland Steel Company, of Sparrows Point, Md., this making the fifth order and being for a 300-kw generator and several motors. Orders were received from the London, England, *Star*, and St. Petersburg, Russia, *Novia Wremia*, two of the most important papers of the respective cities, for the Bullock teaser equipment for operating newspaper presses. Two 300-kw alternating current generators were shipped to the Willson Aluminum Company, of Holcombs Rock, W. Va., to be used in the manufacture of ferrochrome, an electrochemical product used in the manufacture of chrome steel.

$1,000,000 ELECTRIC CONTRACTS.—Contracts for one of the largest electrical plants west of Niagara are being let by the Union Traction Company, of Indiana. They will reach $1,000,000. Power will be generated at this plant for the 158 miles of interurban electric road now in operation or under construction in Anderson, Muncie, Marion, Elwood, Alexandria, Orestes, Summitville, Fairmount, Gas City, Jonesborough, Pendleton, Middletown, and other points. Electric power will also be furnished to housekeepers and manufacturers in all the cities touched by the company. The company claims that it will be able to light cities more cheaply than the cities can operate their own plants. Mr. F. Sargent, of Chicago, is the consulting engineer of the enterprise.

NEW AUTOMOBILE COMPANY.—There is said to be a company forming in Rochester, N. Y., with a capital stock of $5,000,000 to make an approved type of automobile. The new company will be called the Buffalo-Rochester Electric Power & Auto Company, with head offices in Rochester and factory in Buffalo. It is not proposed to manufacture automobiles on a large scale, the real object being to get possession of valuable patents and develop apparatus. Already the new concern has booked orders enough to keep the factory running for a year and a half. G. Alexander Hamilton, of Rochester, will be vice-president and general manager, and many of Rochester's representative citizens and capitalists will be interested.

BIG ENGINES FOR NEW YORK.—The contracts for the big engines for the new Waterside station of the New York Gas & Electric Light, Heat & Power Company have just been placed with the Westinghouse Machine Company. The initial equipment will be eight engines of 6200-hp, working up to 8000-hp and arranged for superheating operation if desired later. They will be compound, 3-crank condensing engines, with one high and two low pressure cylinders. The engines are to be delivered by next fall. It will be remembered that the Westinghouse Machine Company has also been building big engines for Brooklyn and for the Third Avenue Railroad of New York City.

ATHENS, GREECE.—A company has just been formed to be known as the Greek Electrical Company, with a capital of $1,000,000. The founders of the company are the Athens Bank and the Societe Generale d'Enterprises. The object of the new company is not only to undertake electric lighting in Athens, the Piraeus, Syra, Patras and Kalama, but also to construct an electric railroad in Patras. The capital of the company is to be increased, if necessary, and the extensive plant will require considerable material, which will have to be imported. The competition for the machinery and equipment and material will be principally between English, German and American manufacturers.

ELECTRIC CRANES.—Pawling & Harnischfeger, Milwaukee, Wis., report October orders as follows. One 25-ton electric crane, Fraser & Chalmers, London; one 12-ton electric crane, Warrior Machinery Company, Birmingham, Ala.; four 10-ton electric cranes, United States Navy Yard, New York; one 30-ton electric crane, Fraser & Chalmers, Chicago; one 45-ton electric crane, Havana Electric Company, Havana, Cuba; one 5-ton electric crane, Chester Rolling Mill Company, Chester, W. Va.; three 5-ton electric jibs, Midvale Steel Company, Philadelphia, Pa.; and one 10-ton electric crane, Greenslade Foundry Company, Milwaukee, Wis.

STORAGE BATTERY PLANTS.—The Union Traction Company, of Anderson, Ind., which has been the market for a large equipment for its substations and was reported to have placed its orders already, has given a contract to the Electric Storage Battery Company for about 1000-kw of batteries which will be divided up among seven stations, to help operate about 150 miles of road. It is now reported that the crosstown line in New York City on which compressed air has been on trial since May is to give up the air as a dismal failure and that it will equip its cars with storage batteries. They should prove a great success.

JAPANESE TROLLEYS.—Ikuzo Ooka, member of parliament of Japan, and one of his secretaries, H. Matsui, editor of the *Chuwo Shimbun*, of Tokio, of which paper Mr. Ooka is proprietor, traveled last week over the surface lines of the Brooklyn Rapid Transit Company, and visited the eastern district power station on Kent Avenue. After going through the plant, a run was made to Coney Island via the city hall and the old Sea Beach route. Mr. Ooka is interested in street and steam railroads in Japan, and is here to study American methods of transportation. His visit is another indication of the large opportunity opening up for trolley work in Japan.

CLEVELAND TWIST DRILL COMPANY is about finishing its new factory, for which the entire power transmission is electric. The electrical apparatus has been furnished by the Westinghouse Electric & Manufacturing Company, the engines by the Harrisburg Foundry & Machine Company, and the boilers by the Babcock & Wilcox Company. The factory is 230 feet long and four stories in height. The electrical installation will consist of one 150-kw, direct connected, 240 r. p. m., two-phase generator, operating at 240 volts, and 7200 alternations.

HAVANA ELECTRIC RAILWAYS.—The orders for this new electric railway system begin to mount up into large figures, as this department has shown already. Following the order to the General Electric Company for the generating plant, etc., E. P. Allis & Company, of Milwaukee, Wis., now report that they have received an order from Mr. Greenwood for three direct driving vertical cross compound engines of 1600-hp each for the power house. Work is being pushed very actively, and nearly all the orders are for early delivery in 1900.

RUSSIAN BUSINESS.—As was shown by our recent article on the electric dredges for the River Volga, there are large orders for apparatus coming to this country. It is now stated that Mr. Paul K. Brawd, consulting engineer of the Russian Electric Company, of St. Petersburg, is about to make another visit to this country with the object of arranging for the representation of several American concerns in the Russian Empire.

BIG IRON PURCHASE.—A special despatch from Pittsburg of Nov. 3 says that the American Steel & Wire Company has just closed a deal for the purchase of 50,000 tons of basic iron, at market prices, and another deal for the purchase of 50,000 tons of Bessemer iron. This aggregate of 100,000 tons will cost the American Steel & Wire Company, $2,375,000.

THE HAVANA RAILWAY CONTRACTS.—The syndicate which own the Havana Street Railway are still placing orders. Among the new contracts may be mentioned those of equipment, with the McGuire Manufacturing Company, for 150 trucks; the St. Louis Car Company, for 200 cars.

ELECTRIC LIGHT IN BRAZIL.—The authorities of Porto Alegre, Brazil, are inviting bids, until Dec. 31, for the lighting of that city by electricity. The population is 30,000. Information is obtainable at the Commercial Department, Foreign Office, London, England.

TRUCK ORDER FOR ENGLAND.—The J. G. Brill Company, of Philadelphia, recently secured from the Electric Railway & Tramway Carriage Works, of Preston, England, an order for 700 trucks, undoubtedly the largest order of the kind ever received from Europe.

COPPER AT 17 CENTS.—It is reported on good authority that Calumet & Hecla made a large sale of lake copper last week at 17 cents. This was a decline of ½ cent from Monday's price, and since Oct. 1, a decline of a cent and a half per pound.

Special Correspondence.

NEW YORK NOTES.

New York, Nov. 6, 1899.

THE EXCELSIOR ELECTRIC COMPANY.—Judge Bookstaver, of the Supreme Court, has granted a final order dissolving the Excelsior Electric Company, of 115 Broadway, and appointed the temporary receiver, Charles E. Dustin, permanent receiver.

THE BROADWAY CABLE.—It is stated that the electric system will not be introduced on the Broadway line until next summer. This is due to the difficulty experienced in getting electric generating apparatus for the operation of the Metropolitan Street Railway Company's system.

PRES. JAMES W. EAGER, of the Onondaga Dynamo Company, Syracuse, N. Y., was in town last week on business. He reports that his company is well stocked with orders and prospects are good for a heavy fall and winter trade. Mr. Eager went from here to the Philadelphia Exposition, where the Onondaga Dynamo Company has a direct connected set in operation and its new type "E" motor on exhibition.

LIGHTING A PRIZE FIGHT.—The recent big Jeffreys-Sharkey prize fight at Coney Island required special lighting, and the work was put in the hands of Mr. Mortimer Norden, of the Norden Electric Works, 149 West Twenty-eighth Street. In a space 24x25 feet were suspended in eleven rows 400 enclosed arcs of 8 amp., the arcs being exactly 12 feet from the floor. The candle power was about 600,000 without the reflectors, but each row had a tin reflector the entire lighting, throwing the light down at an angle of 45 degrees. Each row was controlled by two triple pole knife switches of 100-amp. capacity each. The entire installation was fed by 22 three-wire circuits, consisting of No. 2 wire for the outsides, and No. 4 for the neutral. The mains from the Brooklyn Edison service were 1,750,000 circular mils for each of the outside wires and 750,000 for the neutral, and were controlled by a 3000 ampere triple pole knife switch. The results were very satisfactory. The pictures of the fight were taken by the American Mutoscope & Biograph Company, and were a success in all the details, being, it is reported, sharper and clearer even than a daylight exposure

ELECTRIC LIGHT INTERESTS IN BROOKLYN.—Meetings of the directors of the Kings County Electric Light & Power Company and the Edison Company were held last week. At the meeting of the Kings County Company it was decided to lease the property to the Edison Company for a term of 38 years. The consideration for the lease was that the Edison Company should pay all of the fixed charges and operating expenses of the Kings County Company, and that whatever surplus was left should be paid to the Kings County Company, to be used as dividends upon its stock, at the discretion of its board of directors. At the meeting of the directors of the Edison Company resolutions were passed merging the Municipal and Citizens' companies, both now leased by the Edison Company, and it is believed that the merging will result in a saving of between $60,000 and $70,000 a year for the combined companies. A. M. Young, one of the directors, said that the Kings County Company had a surplus of $190,000, which represents a 9 per cent. dividend, and he thought that within the next three years the company would be earning 25 per cent. on its outstanding capital. The consolidated stock represented in the merging of the two big companies is about $14,500,000. Under the new order of things the Edison Company will control and conduct all of the electric lighting in Brooklyn Borough.

ELECTRIC SEARCHLIGHTS FOR FIRE DEPARTMENT.—It is difficult indeed to find a place in which, or a condition under which electricity in one form or another cannot be applied to some useful purpose. The New York Fire Department is soon to have a novel addition to its apparatus in the form of a complete electric searchlight on wheels, which will go to fires with the engines, hook and ladder trucks and fire towers, and, it is expected, will do a share of work in saving life and property fully as important as that of any of the other machines. Its purpose will be to light up dark parts of the street and aid firemen in laying hose, setting ladders, and also to light up the fronts of buildings where people may be in danger and to throw light into the buildings themselves, to aid the firemen in searching for missing persons, or other work. The machine will resemble a fire engine in general appearance and will use a similar boiler, but in place of the pumping machinery the engine will drive a dynamo, which will supply the lighting currents for the searchlights. There will be two searchlights, each with an 18-inch projecting lens, and these will be carried on a platform behind the driver's seat. They can be used either from the platform or removed, and carried to any convenient place nearby, their connection with the dynamo being kept up by means of flexible cables. The lights will be provided with lenses which will admit of quick regulation, so that their light may be spread out over a wide area or confined, and directed to any particular point.

NEW ENGLAND NOTES.

Boston, Mass., Nov. 4, 1899.

THE NEW ENGLAND TELEPHONE & TELEGRAPH COMPANY has just announced a reduction in their rates in Springfield and other points in the western portion of the state included in the Springfield district. On Nov. 1 the company discontinued its measured six party line residence rate and substituted therefor a service with the same equipment, without limit as to the number of local exchange calls, for $25 a year, the price now paid for the measured service. These instruments are to be put in without extra charge. The concessions made, however, do not affect the rates to business houses or to other than six party lines. It is also proposed to reduce the three-minute rate on long distance messages exactly one-half. This change will take effect Jan. 1. These concessions in rates are the same as have been made in Worcester and other places and the company announces, in connection with the same, that these are all the reductions that it is now willing to make.

PENNSYLVANIA AND OHIO NOTES.

Philadelphia, Pa., Nov. 6, 1899.

THE ELECTRICAL CONSTRUCTION AND MAINTENANCE COMPANY.—At a meeting of the Electrical Construction & Maintenance Company, just organized, the following officers were elected: President, Henry Hess; vice-president, Dr. J. H. B. Amick; general manager, George J. Jewill. The new company was organized under the laws of New Jersey, with a capital of $100,000. Mr. Jewill, who has been elected to the office of general manager, resigned from the American District Telegraph Company, with which he has been connected in a like capacity for the past 25 years, to accept the position.

AWARDS AT THE EXPORT EXPOSITION.—The Board of Managers of the Franklin Institute, acting under the authority delegated to that institute by the Philadelphia Exposition Association, has notified exhibitors at the National Export Exposition that it will appoint judges who will be empowered to recommend awards. The awards will be the silver medal of the Franklin Institute, with a diploma; the bronze medal of the Franklin Institute, with a diploma; the diploma or certificate of honorable mention. All awards will be based on individual merit, and in no case will they be made by competition. In case of exhibits possessing unusual merit, the judges may in their discretion recommend their reference to the Committee on Science and Arts of the Franklin Institute, for the award of the Edward Longstreth medal of merit, the John Scott legacy premium and medal (granted by the Board of Directors of City Trusts of the city of Philadelphia), or the Elliott Cresson medal. These awards will be made under the regulations as set forth in the by-laws of the Franklin Institute. The reports and recommendations of the judges will be subject to the final approval of the Board of Managers of the Franklin Institute. Among the committees already appointed is the following: Electrical Machinery and Apparatus, subdivided—Dr. E. J. Houston, chairman; Dr. A. E. Kennelly, Carl Hering, C. J. Reed, Prof. Wilbur M. Stine, Prof. George A. Hoadley, C. H. Bedell.

Pittsburg, Pa., Nov. 4, 1899.

MELLON BROS., local bankers, who are the principal stockholders in the Monongahela Electric Light & Power Company, of this city, have purchased the McKee's Rocks Electric Light Company. They paid $100,000 for the plant.

MR. J. S. O'DONOVAN, who has been assistant chief electrician at the Edgar Thomson steel works of the Carnegie Bros. Steel Company, will remove to Youngstown, Ohio, to take charge of a large electric plant, built by the Republic Iron Company of that place.

MR. S. R. DUNELL, an English electrical engineer and a special correspondent of the London *Times*, is now in this city. He will remain here for some time inspecting the Westinghouse and Carnegie interests, and he will "write them up" for the great English newspaper.

MR. C. L. MAGEE, president of the Consolidated Traction Company, of this city, who has been in the east for some time, under the care of physician, returned yesterday to attend the wedding of his sister. In a conversation upon the subject of electric railways in Pittsburg, he said that all the roads would shortly consolidate and be operated by one company under one management.

Cincinnati, Ohio, Nov. 4, 1899.

PRESIDENT W. N. HOBART, of the Triumph Electric Company, has been in New York City this week on important business.

THOMAS J. RYAN has resigned as manager of the local office of the Siemens-Halske Company to take his old position with the Fort Wayne Electric Corporation, of Fort Wayne, Ind.

MR. O. M. HUBBARD, who was in charge of the electrical supply department of the Bradford Belting Company's business, has branched out for himself, opening a store in East Pearl Street.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY has an order from the Plant system of hotels at Tampa Bay, Fla., for poles to be placed about the grounds to carry wires for a fine electric system. This company reports heavy orders for poles for railway construction in Ohio and Illinois, with some orders from Massachusetts.

MR. JACOBS, of the Triumph Electric Company, leaves Sunday night for Cleveland and Pittsburg on important business connected with contracts in those cities. The Triumph Company reports business phenomenal. Many machines of average size are being ordered for delivery in March, which indicates a fear of increased prices next year.

THE POST-GLOVER COMPANY has purchased the electric supply department of the Bradford Belting Company. The latter company instituted this department some years ago, believing it would be appreciated as a part of their rapidly growing belting business. It apparently has not been as successful as they had hoped. It is understood that the Post-Glover people paid something like $16,000 for the business.

THE LAWTON-BEATTIE COMPANY finished its first year's business career as a partnership concern on the first of November. It was an apparently successful venture for both gentlemen. Mr. Lawton said that the profits of the firm had netted a sum twice the amount of their gross capital. Mr. Lawton was for seven years prior to his affiliation with Mr. Beattie superintendent of construction for the allied electric light companies of Cincinnati.

Cleveland, Ohio, Nov. 5, 1899.

A TRUST DEED for $1,000,000, given by the Cleveland & Eastern Electric Railway Company to the Cleveland Trust Company, was filed here a few days ago. The deed was given to secure an issue of bonds authorized by the stockholders of the road at a meeting held on Oct. 31. The mortgage covers the company's line from Cleveland to Middlefield, all further extensions and branches and the franchise and equipment. The bonds bear 5 per cent. interest and are payable in twenty years. The proceeds of the bonds will be the Cleveland & Lorain Electric Railway.

THE BARBERTON, DOYLESTOWN & MASSILLON ELECTRIC RAILWAY COMPANY was incorporated last week with a capital stock of $50,000. Although his name is not mentioned on the incorporation papers, it is understood that Henry A. Everett, the Cleveland street railway magnate, is at the head of the new enterprise. The company proposes to build an electric railway from Barberton to Massillon, touching Hometown, Doylestown, Clinton and Canal Fulton. Franchises for a considerable portion of the road have been secured and work will commence at once. From Massillon to Canton there is already an electric line, but overtures to purchase this have been ineffectual up to the present time, it is said, and it is believed that an extension will be made to Canton. In connection with the Akron, Bedford & Cleveland line and a new road being projected from Akron to Barberton, this would give the Everett people a through line from Cleveland to Canton.

CLEVELAND CAPITALISTS are at the head of an enterprise to build an electric line between Kansas City and Leavenworth, Kan. The new company has been incorporated with a capital stock of $1,000,000, all but $60,000 of which comes from Cleveland. The officers of the company are, D. H. Kimberley, president; H. C. Ellison, vice-president; W. H. Wolcott, secretary, and C. O. Evarts, treasurer; all of Cleveland. The line runs over a private right of way and is without a steep grade or a sharp curve. A new feature will be adopted in the lighting of the cars and in the headlights, which will be to provide them with a complete system of acetylene gas lighting apparatus. The new system of lighting is also a Cleveland experiment, a new concern having recently been formed here to exploit it. G. W. Kinney, James Mathers and L. H. Treadway are at the head of the lighting company.

THE CAR BRAKE PROBLEM.—A few days ago, Cleveland nearly had a duplicate of the terrible viaduct disaster of two years ago. A car crossing Wilson Avenue viaduct at a high rate of speed, struck the derailing switch and crashed through the railing at the side of the bridge, stopping within a length and two feet of the car projecting over the chasm. The motorman made desperate efforts to stop, but so vigorous were his efforts that the brake chains broke. Considerable capital is being made out of this accident by the exponents of other forms of brakes. Some months ago the city council passed an ordinance providing that all cars must be provided with some form of brake other than the existing chain and wheel variety. The street car companies insisted that the chain brake was the best variety known and declined to make any changes, and since then the ordinance has been ignored. Now an effort is being made to have it enforced.

THE ELECTRIC CLUB OF CLEVELAND held its monthly meeting in its club rooms in the Arcade last Thursday evening. At this meeting the new officers elected last month were installed as follows: Charles W. Wason, president; P. Yenson, first vice-president; C. S. Powell, second vice-president; George B. Tripp, secretary; George M. Hoag, treasurer; Samuel Scovil and George W. Cleveland, house committee. The board of managers are: Chas. W. Wason, George B. Tripp, George M. Hoag, Elmer A. Sperry and W. A. Curter. The club numbers among its members nearly all the prominent electricians in this city, and is a thriving organization. The evening was taken up largely by the reading of a paper on electrical brakes, illustrated by lantern slides, by F. E. Case, of the General Electric Company, of Schenectady. The brake dealt with principally in this paper is now in use on the cars of

WESTERN NOTES.

Chicago, Ill., Nov. 4, 1899.

COL. S. G. BOOKER, general manager of the Phoenix Battery Manufacturing Company, St. Louis, paid his many friends in Chicago a visit this week.

MR. JOHN MURPHY, prominent in Indianapolis as an electrical engineer, is visiting Chicago this week. Mr. Murphy reports that business is booming, and the outlook encouraging for the future.

MR. F. S. TERRY, vice-president of the Sunbeam Incandescent Lamp Company, Glen Ridge, N. J., well known throughout the electrical fraternity as a leader in his line, paid Chicago a visit during the week.

ELECTRIC VEHICLE.—At Springfield, on Nov. 3, the secretary of state licensed the incorporation of the Illinois Electric Vehicle Transportation Company, with a capital of $350,000. The company is the New Jersey corporation which has already begun to put vehicles on the streets of Chicago.

COMPENSATION FOR A FRANCHISE.—Suit for $12,000 has begun in the superior court at the instance of the village of Wilmette against the Chicago & Milwaukee Electric Railroad Company. The amount is claimed as compensation for the franchise granted to the defendant company allowing it to run its tracks through the village.

ONE HUNDRED NEW CARS IN CHICAGO.—The Union Traction Company has made plans for the construction of 100 new cars in the company's shops between now and next spring. In addition to this increase the company will place in service by spring 100 cars that have been out of use for a year or so, and which need only repairing and repainting.

CHICAGO RAILWAYS TO BE INVESTIGATED.—The common council next Monday will act upon an ordinance providing for a commission to investigate the street railways of Chicago and report on the best means of dealing with them. The ordinance is looked upon by those interested in such matters as the only feasible way of dealing with the street railways on a strictly business basis when applications for renewals of franchises are made.

MECHANICAL DRAFT.—An illustration of the results attending the use of mechanical draft is presented in the experience of the Utica Portland Cement Company, of Utica, Ill. The change was recently made from a chimney to a Sturtevant fan as a means of draft production. They say that formerly five boilers were used and trouble was experienced in keeping up steam with a good grade of coal. They now use four boilers, and with coal costing 35 cents per ton less they state they have no trouble in keeping a good head of steam.

CONSOLIDATION OF STREET CAR REGISTER INTERESTS.—It is reported that the Meaker Manufacturing Company, whose factory is located at North Chicago, and the Sterling Supply & Manufacturing Company, of New York, are to be consolidated. The two firms are said to manufacture 90 per cent. of the fare registers used in street cars. The new company, according to the report, will be called the Sterling-Meaker Manufacturing Company. It is said the New York company's plant may be brought West. An official of the Meaker Company said that, while the deal had been talked of, no further action toward a consolidation had been taken.

FIRES AMONG ELECTRICAL HOUSES.—Fires were plentiful in Chicago during the present week, and several firms in the electrical trade suffered several heavy losses. The explosion of a gas engine in the plant of Becker Bros., manufacturers of electric apparatus at 35-43 W. Washington, caused the fire which destroyed the building on Nov. 1, entailing a loss of $98,000. Becker Bros.' loss of $6000 is fully covered by insurance. The Simpson Dynamo Company, who occupied space in the same building, sustained a loss of $6000, and E. Reed Burns, electroplater, suffered a loss of $4000. Fire and water caused $50,000 damage to the occupants of the seven-story building at 88-92 Jackson Boulevard on Nov. 1. Among the losers in this building are Roth Bros. & Co., manufacturers of dynamos and motors, and the Heyer Storage Battery Company, both well known in the electrical trade.

Minneapolis, Minn., Nov. 4, 1899.

REDUCING RUNNING TIME.—The Twin City Rapid Transit Company has reduced the running time on the Como Interurban line. The time is now 54 minutes between St. Paul and Minneapolis on both lines.

RAILWAY FRANCHISE IN SAULT STE. MARIE.—The common council of Sault Ste. Marie last week granted a 20-year franchise to Emil G. Endress and other local capitalists to build a street car line in the Soo.

NEW TELEPHONE LINES OPENED.—The Northwestern Telephone Exchange Company's long distance system is now in working order to West Superior. The mayors of Minneapolis and Duluth formally opened the line.

TELEPHONE GIRLS ORGANIZING.—Telephone exchange operators of St. Paul and Minneapolis held a meeting recently for the purpose of organizing a union. The meeting was conducted by the organization committee of the Trades' Council.

LONG DISTANCE TELEPHONE COMMUNICATION.—The formal opening of the American Telephone and Telegraph Company's long distance line took place at Superior, Minn., on Oct. 30. One of the features of the evening was the music played by a prominent band in Milwaukee.

A MUNICIPAL ELECTRIC LIGHTING PLANT has been installed at Brookings, S. D., by W. I. Gray & Co., of Minneapolis. The plant consists of a 65-hp Corliss engine, 40-kw Crocker-Wheeler direct current generator and two small compensating motors. It is a 220-volt three-wire system.

TWO HARBORS, MINN., has let the contracts for a $15,000 electric lighting plant. A 90-kw General Electric belted alternating current generator will be used. Twenty enclosed alternating current constant potential arc lamps have been purchased for the street lighting. The plant will be completed by Nov. 15.

ENLARGING A WATER-ELECTRIC PLANT.—The electric lighting plant at Brainerd, Minn., is being remodeled and enlarged. A new apron has been put on the dam, and pulleys, line-shafting, turbine water wheel and two 120-kw separately excited 60-cycle alternating current General Electric generators, together with a new switchboard, added to the plant.

MINNEAPOLIS' WIRE ORDINANCE AMENDED.—An amendment to the underground wire ordinance has been passed by the city council of Minneapolis, the clause relating to the forfeiture of poles, etc., to the city if left in the underground district after Dec. 1, 1903, being stricken out. It was understood by all that the ordinance was amended in order to enable the Mississippi Valley Telephone Company to compete with its rival.

Indianapolis, Ind., Nov. 4, 1899.

THE CAPITAL STOCK of the Elkhart Telephone Company has been increased from $25,000 to $50,000.

LONG DISTANCE LINES EXTENDED.—The New Long Distance Telephone Company, of Indianapolis, has completed its line to Columbus and North Vernon, and will soon reach Madison.

A NEW FRANCHISE GRANTED.—An electric light and water works franchise has been granted to the Knox Light & Water Company by the town of Knox, which reserves the right of municipal purchase at the agreed price of $32,500.

TELEPHONE FRANCHISE GRANTED.—David E. Miller, manager of the Flora & Bringhurst Telephone Company, has been granted a franchise to construct and operate an exchange at Frankfort. It is the intention to connect the Miller lines with the lines of the new company at Indianapolis.

FREE TELEPHONE SERVICE.—President Daugherty, of the United Telephone Company, of Indiana, including many cities in Northern Indiana, has granted free telephone service to the municipal league or the police and detective forces in the league when in pursuit of criminals.

THE NEW TELEPHONE COMPANY WANTS DAMAGES.—The new telephone company asks to be made a party to the condemnation proceedings by the government of square 36, in Indianapolis, for a new postoffice building. It wants damages for being compelled to take up its conduit lines running through the square.

POOR SERVICE AT TERRE HAUTE.—Since doing away with the six-for-a-quarter fare tickets the Terre Haute Street Car Company has cut off several branch lines and curtailed the service on the remaining. The people are much dissatisfied and are looking about for a remedy.

JEFFERSONVILLE'S NEW LINE.—Capt. Howard, proprietor of the shipyards and owner of the street railway line, has decided to put in an electric

system, and will soon begin work making the change. The system will be extended to the Southern Prison and to the Arctic Springs, a pleasure resort of considerable note.

TO MAKE AUTOMOBILES EXCLUSIVELY.—The Indiana Bicycle Company, of Indianapolis, one of the concerns operated by the new trust, will discontinue the manufacture of bicycles and devote its attention exclusively to the manufacture of high grade motor vehicles, ranging in price from $1000 to $3500. The trust is responsible for the new order of things.

PROVIDES FOR DAMAGES FROM ELECTROLYSIS.—The new franchise granted by the City of Muncie last week to the Muncie Interurban Electric Railway Company provides that the company must be responsible financially for all damages resulting from electrolysis along its route within the city limits. The company has signified its willingness to accept the conditions.

MUNICIPAL OWNERSHIP.—Decisive steps have been taken for the erection and ownership of an electric light plant and a local telephone system at Frankfort, Ind. The causes are said to be on account of advancing rates, the Bell Telephone Company having increased rental rates from 40 cents to 80 cents a month, the rate in force for the past two years, to $2 and $3 a month for residences and business houses.

STREET RAILWAY FREIGHT.—The announcement by the Indianapolis Street Railway Company that it would freight coal through the city by night is meeting with much opposition. The company has asked permission of the city to do this. The franchise gives the company a right to haul its own material over its own tracks, but prohibits the hauling of the material of any one else, except the United States mails.

TELEPHONE COMPETITION.—After sixteen years of monopoly the Central Union Telephone Company, of Kokomo, is to have competition. The city council, of Kokomo, on Oct. 24, granted a 15 years' franchise to a new company, represented by Si Sherin, of Indianapolis, and Hugh Daugherty, of Bluffton, who agree to furnish service at two-thirds the rates charged by the old company. The plant is to be in operation in 90 days.

INVESTIGATING THE DANVILLE ELECTRIC LINE.—Representatives of a large financial company in New York were in Indiana last week looking over the right of way and franchise of the Danville Electric Line proposed to be constructed between Indianapolis and Danville via Plainfield. The early construction of the line will depend on the report made by these representatives, which the company interested hopes to be favorable.

EMPLOYEES DISMISSED.—The combination which controls the Indiana bicycle plant is carrying out its plan of discontinuing the manufacture of complete bicycles. The Indiana Company employed 3800 agents in the United States and foreign countries, and they have been suspended. Nearly 2000 employees have been dismissed, but many of these will be engaged again when the plant begins the building of automobiles and increase the output of the rubber tire department.

A NEW RAILWAY COMPANY CHARTERED.—A new company has been chartered to take hold of the street railway lines at Fort Wayne. The company is the Fort Wayne Traction Company and the capital stock is $2,000,000. The incorporators filed articles of association on Oct. 30 and signed thereto are the names of George A. Garretson, H. P. McIntosh, James Parmalee, J. H. Wade, H. P. Ellis and E. H. Bourne as directors. The company will build and operate lines radiating from Fort Wayne.

THE TELEPHONE SITUATION AT SOUTH BEND.—The Citizens' Telephone Company opened for business in October, 1896, as a competitor of the Bell Company. It began with 500 subscribers, who had obligated themselves to five years' service. The Bell Telephone was driven out of the police and fire departments, and the Citizens' Company, with many shareholders among the business men and a constant demand for more telephones, seemed on the high road to permanent prosperity. The Bell folks made a cut below the Citizens' Company's rate, and then, under one pretext and another, the patrons began falling off, and eventually they rushed back to the Bell Company. Then stockholders began to unload and the days of the Citizens' Company are numbered, for a fragment only are holding out against the Bell Company's offer. The Citizens' plant represents an outlay of about $80,000. It is the second attempt to operate an independent telephone company in South Bend. It is likely to be many years before the Central Union will again have opposition here.

TELEPHONE BUSINESS AT INDIANAPOLIS.—The two telephone companies are pushing the extension of their lines, placing new switchboards and making connections for large numbers of new patrons. By winter it is claimed at least one-half of the people will be enabled to converse without leaving home or business. The officers of the new company have found it necessary to lay new cables and place new switchboards in the operating room for the accommodation of the new subscribers. Vice-President Sherin says that throughout Indiana the independent companies are rapidly increasing their connections with other cities. In small cities and also on the farms, the telephones are now regarded as a matter of necessity. Secretary Hill, of the Bell Company, says that his company is making marked improvements, owing to the increase of business. New switchboards are being placed and the business of long distance lines is increasing. He predicts by the middle of the month the company will have nearly 5000 telephones in operation in this city.

St. Louis, Mo., Nov. 4, 1899.

ELECTRIC RAILWAY PROJECTED.—W. J. Pallard, John Vey and C. F. Ringseggar, all residents of Buchanan County, have asked the county court for franchise for an electric railway. They propose to build a line from St. Joseph to Savanah, Andrew County. It will cost $100,000.

CHANGING INCANDESCENT LAMP SOCKETS.—The Missouri-Edison Electric Company is gradually changing the sockets on the incandescent lamps in use by their patrons. The sockets heretofore in use were the Westinghouse sockets, and the one which the company is using to supersede them is the Edison socket. The patrons do not like the change as it causes extra expense. Two hundred and fifty thousand sockets are estimated to be in use in this city and of this number 200,000 are the old ones. As the cost of making the change is about 40 cents apiece, the change is not liked.

THE WESTERN ILLINOIS TELEPHONE ASSOCIATION.—A new association, called the Western Illinois Telephone Association, was formed at Carlinville, Ill., Nov. 1. The members of the Association comprise the various telephone companies in the western portion of that state. The offieers of the association will be named in a day or two. The temporary organization elected Mr. J. A. Fletcher, of Carlinville, Ill., chairman. About 25 persons were present at the first meeting and the time before the permanent organization was spent in talking over rates and construction.

THE WESTERN ELECTRICAL SUPPLY COMPANY this week entered into an arrangement with the Victor Telephone Manufacturing Company, of Chicago, to take its entire product and supply all the territory west of the Mississippi River. This is a big contract as the Victor Telephone Manufacturing Company is a large company and manufacture a large quantity of goods. The energy and push of the Western Electrical Supply Company is the result of this deal as their business is fast growing and the produce acquired by this contract is necessary in order to fill the large demand that is continually made upon them.

VALUATION OF RAILWAYS, ETC.—The valuations of street railways in St. Louis fixed by the State Board of Equalization have just been made public. They are as follows: Cass Avenue and Fair Grounds, $1,309,308.75; Citizens', $1,082,250; Delmar Avenue, $1410; Clayton and Forest Park, $13,080.65; Compton Heights, Union Depot and Merchants' Terminal, $499,500; Grand Avenue, $827,640; Lindell, $2,004,750; Missouri, $2,168,541; People's, $379,000; Southern Electric, $741,369.67; St. Louis, $2,484,315; St. Louis and East St. Louis, $147,881.14; St. Louis and Meramec River, $235,477.22; St. Louis and Suburban, $1,026,010.99; Taylor Avenue, $247,500; Union Depot, $3,328,233.30; total, $16,665,917.72. The valuations of telegraph companies are as follows: Missouri District Telegraph Company, $15,061,781; Postal Telegraph Cable Company, $2,390.75; Western Union Telegraph Company, $80,820.45.

SOUTHERN NOTES.

Memphis, Tenn., Nov. 4, 1899.

THE ELECTRICAL WORKERS have completed their organization and are working under the rules of other labor orders here. The regular members expect great improvements in the work done in the near future. Weekly meetings are held at Union Labor Hall.

MESSRS. W. S WALKER & CO. have just secured two large wiring contracts—one in the Clay Building on Main Street. This is a four-story building. The other is the new building being put up on Madison Street for the Cumberland Telephone & Telegraph Company.

ACTIVITY IN ELECTRICAL BUSINESS.—Business in the electrical line out here both in goods and work is very active. Last week a full spool of annunciator wire could not be purchased in the city, and now it is almost impossible to find men to do the work going on about the city.

THE CITIZENS' STREET RAILWAY COMPANY is preparing to move its shops and car barn to a location where it will have more room and where safer and better buildings can be erected. About $50,000 will be expended in making this change. In addition to this work the company will build about 10 miles of new track in the next few months.

THE CUMBERLAND TELEPHONE & TELEGRAPH COMPANY has just closed a deal with Messrs. Cotten & Gibson to take over the Iuka (Miss.) telephone exchange, Cotten & Gibson retaining the switchboard and telephones. Low rates, poor construction and bad service, inaugurated and put in by men of no experience in the telephone business, compelled these men to sell.

MR. A. M. GIBSON has taken charge of the Osceola & Memphis telephone lines and will put them in first class order. Metallic circuits will be used between Memphis and Richardson's Landing, Tenn., at which point the line crosses the Mississippi River by an overhead wire. From that point to Osceola a ground circuit will be used. There are 19 of the Viaduct Manufacturing Company's multiple telephones in use on these lines.

General News.

THE TELEGRAPH AND TELEPHONE.

WILMINGTON, DEL.—The Delmarvia Telephone Company, whose exchange is at Seventh and Orange Streets, Wilmington, has opened a substation on West Sixth street.

GEORGETOWN, S. C.—The Georgetown Telephone & Telegraph Company desires to obtain estimates on telephone and telegraph supplies. Mr. S. S. Ingman is secretary of the company.

BALTIMORE, MD.—The Maryland Telephone & Telegraph Company is preparing plans for three substations in this city to accommodate 1000 instruments each. The cost of each station will be $5000.

EAU CLAIRE, WIS.—The Wisconsin Telephone Company has bought a lot near the center of the east side and will erect a building to cost $20,000 for exchange purposes and general offices of the Northern district.

PLANT, TENN.—The Humphreys County Telephone Company, recently organized here, bought the plant of an old company. It is making some improvements in the system and will want a new and larger switchboard.

ROME, N. Y.—The Constableville & West Leyden Telephone Company contemplates the extension of its lines from Boonville to Forestport and Alder Creek; from Lee Center to Camden; from Rome to Lowell and from Lowville to Carthage.

TRENTON, N. J.—The Federal Telephone Company filed a certificate in the office of the Secretary of State on Oct. 31, setting forth that its entire capital

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of $10,000,000 was paid in. Only $2000 is in cash, however, the rest being in real estate and other property.

TEXARKANA, TEX.—The telephone wires from this point to DeQueen, Ark., a distance of seventy-five miles north of Texarkana, have been completed. The Postal Telegraph Company's wires to Shreveport are also finished and correspondence with that place opened.

MINEOLA, L. I.—The Nassau County Board of Supervisors has granted to the South Shore Telephone Company a franchise for the extension of its local telephone service through the county. The company is endeavoring to establish an independent telephone service on Long Island.

ST. PAUL, MINN.—The Grove City & Rosendale Telephone Exchange Company, of Grove City, has been incorporated to conduct and operate telephone exchange. Capital, $2000. Incorporators: B. Bresden, N. N. Waylander, A. Liedholm, of Grove City; M. P. Madson, L. P. Sorenson, H. P. Anderson, all of Rosendale.

NASHVILLE, TENN.—At their last meeting the Board of Directors of the Cumberland Telephone & Telegraph Company was authorized to increase the stock of the company 25 per cent. in order to provide funds for the growth of the company's business. Under this authorization the stock of the company has been increased approximately $800,000.

YANKTON, S. D.—The Iowa, Minnesota and Dakota Telephone Company which was recently organized, will operate in connection with the Western Electric Telephone system. Next season it will build 500 miles in South Dakota. The Western Electric system includes the following named companies: Iowa, Minnesota & Dakota Telephone Company, Minnesota Central Telephone Company, Minnesota Mutual Telephone & Telegraph Company, Western Minnesota Telephone Company, Southern Electric Telephone Company, Southern Minnesota Telephone Company, Western Electric Telephone Company, Southern Dakota Telephone Company, Standard Telephone Company of Missouri, Central Missouri Telephone Company, Russell Telephone Company. The system has an aggregate of 6000 miles of circuit.

ELECTRIC LIGHT AND POWER.

NEW CITY, N. Y.—A franchise has been granted to the Rockland Light & Power Company.

ANNISTON, ALA.—The Anniston Electric Company has been granted a franchise and will install Westinghouse apparatus.

TWO HARBORS, MINN.—It is expected that the new Two Harbors electric light system will be finished and running by Nov. 15. It is owned by the city.

MONTGOMERY, W. VA.—The Kanawha Traction & Electric Company will erect a power plant. Mr. E. W. McCormick is the manager of the company.

PINE BLUFF, ARK.—An effort is being made here to have an electric light plant established by the city. The mayor can give further information on the subject.

REYNOLDSVILLE, PA.—An electric light franchise has been granted to Mr. E. H. Ferrin, of Harrisburg, Pa., who recently secured a franchise for a street railway.

VINCENNES, IND.—The new City Electric Lighting Company of Vincennes executed recently a trust deed of $98,000 with the Northern Trust Company of Chicago.

HAZELHURST, MISS.—A franchise has been granted to Mr. P. N. Miller, who will require poles, water wheel, etc. The capacity of the plant, it is stated, will be 1000 lights.

AUBURN, ILL.—The Auburn Electric Light Company has been incorporated to furnish electricity for lighting and power. Capital, $8000. Incorporators: J. A. Wheeler, W. H. Ramsey, G. W. Hutton, all of Auburn.

ANNISTON, ALA.—The Anniston Electric & Gas Company of Anniston, Ala., has been incorporated in New Jersey with a capital of $250,000. Incorporators: W. H. Brearley, G. W. Perkins, and K. K. McLaren, all of Jersey City.

TALLAHASSEE, FLA.—At a recent election it was voted to issue $16,000 of bonds for the erection of an electric light plant. Mr. O. C. Van Brunt is the city clerk, to whom all communications for further information should be addressed.

STOCKTON, CAL.—The power house of the Standard Electric Company, located at Blue Lake City, was totally destroyed by fire on Nov. 1. The loss will reach $75,000. Several large enterprises depending upon the electric plant for power will suffer great inconvenience.

LUDLOW, VT.—An electric light plant is to be established in Grahamsville, Vt., next spring at a cost of $25,000. The amount was voted by the citizens of Grahamsville and the plant will be operated by the authorities. Mr. E. H. Randall, of Poultney, Vt., is engineer.

POINT MARION, PA.—The Springfield Electric Light & Power Company, of Point Marion, has been incorporated to supply light, heat and power. Capital, $1200. Incorporators: A. S. Maple, O. A. Miller, both of Point Marion; F. S. Ruff, J. J. Quertimort, J. J. Mayer, all of Jeanette.

HAMILTON, ONT.—The Hamilton Electric Light & Cataract Power Company, which is incorporated with a capital stock of $3,750,000, is preparing to tap Niagara's power and utilize the energy in propelling electric trolley systems in the Niagara peninsula in Ontario, and incidentally proposes to light all the towns and cities in that territory for a distance of forty miles. The company has acquired control of the following six companies: Hamilton Street Railway Company, Hamilton & Dundas Street Railway Company, Hamilton Radical Electric Railway Company, Cataract Power Company, Hamilton Electric Light & Power Company, and the Electric Power & Manufacturing Company.

THE ELECTRIC RAILWAY.

PITTSFIELD, MASS.—The Pittsfield Electric Street Railway Company will extend its line to Lenox and double track a portion of the Pittsfield line.

NORTHAMPTON, MASS.—It is reported that surveys will soon be made for an extension of the Northampton Street Railway to Holyoke, via Smith's Ferry and Mount Tom.

POUGHKEEPSIE, N. Y.—Judge Barnard has continued the injunction obtained by the village of Bronxville against the New York, Westchester & Connecticut Traction Company.

WASHINGTON, D. C.—The district commissioners have granted a permit to the City & Suburban Railway Company to reconstruct its overhead trolley line on a section of its line.

BROCKTON, MASS.—The Brockton & Plymouth Street Railway Company has been incorporated, with a capital stock of $150,000. Mr. W. M. Butler is president and G. A. Butman, treasurer.

TRENTON, N. J.—The Jersey City, Hoboken & Paterson Street Railway Company, with an authorized capital of $20,000,000, was incorporated here on Nov. 1. This is a consolidation of several companies.

MARION, IND.—The Marion Transit Railway Company has been incorporated with a capital of $150,000. Incorporators, E. H. Ferroe, J. A. Gauntt, A. S. Wade, P. Peslle, W. T. Caumack, H. Williamson, M. Petrie, all of Marion.

COUNCIL BLUFFS, IOWA.—The Omaha, Council Bluffs & Suburban Railway Company has been incorporated with a capital of $1,000,000. Incorporators, W. S. Reed, A. B. de Long, S. Townsend, C. R. Hannan, all of Council Bluffs.

TERRYVILLE, CONN.—The Torrington & Hartford Electric Railway Company contemplates the extension of its line from Torrington to Terryville, a distance of 11 miles, to meet an extension of the Bristol & Plainville Tramway from Bristol to Terryville.

SARATOGA, N. Y.—The Saratoga Traction Company has secured the necessary consents in the town of Malta for the extension of the road from Ballston Spa to Mechanicville. It is not expected that any difficulty will be experienced over the remainder of the route.

SCRANTON, PA.—Edward Gunster, of Wilkesbarre, is at the head of a project to construct an electric railway between Wilkesbarre and Scranton, to be called the Wilkesbarre, Pittston & Scranton Railway. Application for franchise has been made in Scranton.

MICHIGAN CITY, IND.—Michigan City capitalists are figuring on the construction of an electric railway connecting this city with Valparaiso, via Westville. The project is said to be backed by Martin T. Krueger, Senator Uriah Culbert and Dr. M. A. Schutt.

MILWAUKEE, WIS.—The company to be known as the Milwaukee & Muskego Lakes Electric Railway Company has been incorporated. Its capital stock is $25,000, which is to be increased shortly to $300,000. Interested with the incorporators in the project are John Johnston, Carroll M. Towne and Fred J. Johnson.

FALL RIVER, MASS.—The Fall River & Brockton Air Line Street Railway Company has been organized, with a capital stock of $150,000, to build a street railway from Westport to Rochester, a distance of 15 miles. The incorporators are Abbott P. Smith, New Bedford, Mass.; Charles H. Wilson and Fred C. Hinds, of Boston.

MEDFIELD, MASS.—The Medfield & Medway Street Railway Company has been incorporated, with a location from the terminus of the Norfolk Western Street Railway in Medfield through Millis to Medway, seven miles. The capital is $50,000, and the directors W. W. Mitchell, J. J. Feeley, H. L. Howard, H. J. Dunn, R. G. Fairbanks, A. M. Bates and A. C. Smith.

TIFFIN, OHIO.—R. W. Brown, Dr. William M. Starr, Richard Young, H. S. Fry, Samuel P. Galef, capitalists from Washington, D. C., and Frank E. Anderson, of Alexandria, Va., were in this city a few days ago, looking over the proposed electric railway, starting from Toledo, passing through Tiffin, Fremont, Port Clinton and Sandusky. When completed it will be one of the largest electric roads in the United States.

DAYTON, OHIO.—The Dayton & Germantown Traction Company, recently organized, will change its name to Dayton Soldiers' Home & Germantown Railway, and increase its capital from $10,000 to $600,000. The company contemplates extending its line to Troy and Oxford. This enterprise is said to offer an excellent chance for a company to complete the entire road. Payment for the construction will be made part in cash and part in bonds.

JOHNSTOWN, PA.—It is now officially admitted that the Johnstown & Somerset Traction Company, which some time ago secured a valuable franchise for nothing from the city council, has sold its grant to the Johnstown Passenger Railroad Company, the heavy end of which is Tom L. Johnston. It is also practically assured that the Johnstown Passenger Railroad Company will construct an electric railway to Windbar from this city at once.

MIDDLETOWN, N. Y.—The Middletown-Goshen Electric Railway Co., a reorganization of the Middletown-Goshen Traction Company, has filed articles of incorporation. The capital is $100,000, and the directors are William B. Broomall and J. Howard Roop, of Chester, Pa.; William F. Biddle, Louis A. Duhring, Joseph P. Brosius, Frank D. Graham and E. H. Pyle, of Philadelphia, and William B. Royce and H. B. Royce, of Middletown.

WAREHAM, MASS.—The Boston & Cape Cod Railway has been incorporated. The proposed route is from Freetown line, through Rochester, Wareham and Onset to Buzzards Bay. At Freetown it will form a connection with the Lake Shore which was recently built and with a proposed road to Fall River. With these connections the new line will open up electric car communications with New Bedford, Fall River, Middleboro and Boston.

TUCKAHOE, N. Y.—The New York, Westchester & Connecticut Traction Company is tearing up the tracks of the Union Railway Company laid in the White Plains road. The temporary injunction obtained by the town authori-

ties restraining the traction company from building a trolley road under an old franchise granted to the North Mount Vernon Railway Company in 1895 was dissolved a few days ago. This franchise the traction company had purchased.

PITTSBURG, KAN.—The Pittsburg, Frontenac & Suburban Electric Street Railway lines were sold at sheriff's sale to J. J. Tyler, of Philadelphia, the heaviest stockholder in the concern, for $70,000. This sale will terminate the receivership of the line, and under the new management an extension of the line will be made from Frontenac to Yale mining camp, a distance of four miles, at once. A further extension from Chicopee to Weir City is also contemplated.

ALLENTOWN, PA.—The final step was taken in the case of the Old Colony Trust Company, of Boston, vs. the Allentown & Bethlehem Rapid Transit Company, by the latter paying the former $296,000, the judgment for which was assigned to the New York Surety Company and reassigned to the Penn Mutual Life Insurance Company, of Philadelphia. A reorganization of all the local trolley companies is under way, and a stockholders' meeting has been called for Nov. 17 to sanction the plan. Albert L. Johnson and ex-Congressman Tom L. Johnson are the principal stockholders.

RA...DVILLE, MASS.—What is claimed by railroad contractors as a remarkable piece of construction work was accomplished here a few days ago by the laying of seven and a quarter miles of standard 100-pound rails in practically five hours. The work was so timed that it did not delay the regular traffic over the New York, New Haven & Hartford Railroad at this point, which is quite heavy. The track layers, in three gangs, progressed at a fair walking gait. In putting down the new rails the entire electrical arrangement of switches and signals was broken, and its re-establishment was accomplished on even terms with the track work.

CONSOLIDATION IN NEW JERSEY.—The Jersey City, Hoboken & Paterson Street Railway Company, a branch of the Shanley trolley system, which includes a majority of the street railway lines in northern New Jersey, was organized on Nov. 1 in the office of the North Hudson County Railway Company, in Hoboken. The officers elected are: President, David Young, of Newark; vice-president, John F. Shanley, of Newark; treasurer, George W. Roe, of Newark; secretary, William C. Doubleday, of Jersey City. Nine trolley companies were merged into the new company. They were the North Hudson County Railway Company, the Paterson Street Railway Company, the Paterson Central Electric Railway Company, the Saddle River Traction Company, the Palisades Railroad Company, the White Line Traction Company, the Paterson, Passaic & Rutherford Electric Railway Company, the Jersey City, Hoboken & Rutherford Electric Railway Company and the Paterson Horse Railroad Company. The capital stock of the new company is $20,000,000. Many of the officers are identified with the North Jersey Street Railway Company, which is the main corporation of the syndicate. President David Young, of the new company, is general manager of the North Jersey Street Railway Company. He will be general manager of the new company also. The company will improve its system in Hudson County and extend its lines in Passaic and Bergen counties.

THE AUTOMOBILE.

AUTOMOBILE MANUFACTURERS NOT FULL MEMBERS.—At the 27th annual convention of the Carriage Building National Association of the United States, recently held in Indianapolis, a proposition to admit manufacturers of automobiles as full members was voted down.

NEW COMPANIES.

W. A. FULLER ELECTRIC COMPANY, St. Louis, to deal in electrical machinery. Capital, $5000. Incorporators: W. A. Fuller, J. B. Carroll, G. W. Grant, all of St. Louis.

STORAGE POWER COMPANY is a new concern intended to develop systems of utilizing superheated water as a source of power, one use being in autotrucks. Among those named as directors is Mr. F. L. Nicholls.

ELECTRICAL CONSTRUCTION & MAINTENANCE COMPANY OF AMERICA.—Principal office, Camden, N. J.; to manufacture electrical contrivances. Capital, $100,000. Incorporators: Charles S. Reber, William H. Stirling, Daniel S. Mishoe, all of Camden, N. J.

CONSOLIDATED ELECTRIC COMPANY, Manchester, N. H.; to carry on a general electrical business. Capital, $250,000. Incorporators: A. E. Mason, F. L. Irby, E. W. Kellogg, all of Boston; T. H. Armstrong, of Waltham, Mass.; E. S. Whitney, of Manchester, N. H.

EDUCATIONAL.

TRINITY COLLEGE, HARTFORD.—It is stated that Dr. Robb's new course in electrical engineering is proving immensely popular. New apparatus has been fitted up in the basement of Faur's laboratory. The valedictorian of '98, W. McA. Johnson, is studying electrochemistry in the University of Goettingen, Germany.

THE COLLEGE OF THE UNIVERSITY OF PENNSYLVANIA, in a recently issued pamphlet, gives a brief description of the courses of instruction at this institution. The course in mechanical and electrical engineering is complete and well arranged, and the laboratory is equipped with modern apparatus. Much information regarding the university is also given in the pamphlet, a copy of which may be obtained by any one interested.

CORNELL UNIVERSITY.—Non-resident lecturers in mechanical engineering are announced as follows: Dec. 1, Prof. Houston, on "Evolution of Electric Energy." Dec. 15, William Kent, on "Power Production." Jan. 12, H. E. Longwell, on "New Westinghouse Gas Engine." Jan. 19, A. E. Kennelly, on "Electrical Engineering Experiences." Jan. 26, C. J. Field, on "Safe Current Transmission." Feb. 23, W. B. Potter, on "Three-Phase Railway Work." April 13, Elihu Thomson, on "Special Work in Electrical Engineering." April 27, E. W. Rice, Jr., on "Dynamo and Engine Construction." May 4, W. M. Macfarland, on "Recent Engineering Practice."

INDIANAPOLIS, IND.—The Union Traction Company propose doing an express and package business. Arrangements are being made with merchants in Indianapolis to deliver purchases made by out-of-town people to any town along the entire system. The plan devised is to make a rate for delivery only sufficient to cover the cost of handling the business in the hope that a larger number of passengers will be brought to Indianapolis. Fares are to be refunded also when purchases amount to a certain figure. The merchants turn the packages over to the Union Traction Company and the conductors turn them over to the station agents, who deliver them to the residences. The company proposes the erection of waiting rooms in each town along the line and the Indianapolis waiting room will be fitted up very elaborately.

PERSONAL.

PROF. JOHN TROWBRIDGE, who has an excellent article on wireless telegraphy in the recent Popular Science Monthly, delivered a lecture on this subject last month before the Electrical Club at Harvard.

EDISON—FOWLER.—At Elizabeth, N. J., on Nov. 7, William Leslie Edison, son of Thomas A. Edison, was united in marriage at noon with Blanche Fowler Travers, daughter of the late Dr. Edward Fowler, of Maryland. The wedding took place at Sunnyside, the residence of Miss Cecilia Ryan.

MR. J. R. BAINTON, representing the firm of Edge & Edge, Sydney, Australia, is in the United States investigating various electrical apparatus and novelties with a view to introducing them in that country. Mr. Bainton's address is in care of the Australian Department of Flint, Eddy & Co., 30 Broad Street, New York.

MR. J. H. McCLEMENT, who was for some time comptroller of the old parent Edison Electric Light Company, etc., and has been interested in various electrical enterprises, has joined as a partner the well known Wall street house of Geo. P. Butler Company. His financial abilities and experience will be found of great advantage by old and new associates.

MR. JOHN C. BRIDGMAN has been elected general manager of the Hazard Manufacturing Company, of Wilkesbarre, Pa., to succeed Mr. W. Gaston, who becomes general manager of the Taylor Iron & Steel Company, of High Bridge, N. J. Mr. S. L. Brown has become treasurer of the Hazard Company, which is now manufacturing insulated wire as one of its specialties.

OBITUARY.

JOHN JACOB BERGER.—We regret to learn from the Troy *Press*, N. Y., the death on Oct. 24 of Mr. J. J. Berger, after a lingering illness. The deceased was born in East Millstone, N. J., Nov. 5, 1865, and in 1882 he entered the Rensselaer Polytechnic Institute. He was graduated in 1886, and stood first in his class. He entered Cornell University for a post-graduate course, and there he obtained a degree of M. E. The deceased became one of the most capable electrical engineers in Troy and carried out some of the largest contracts awarded in this section of the state. Mr. Berger was one of the organizers of the Y. M. C. A. at the institute, and was one of the charter members of the local chapter of the Zeta Psi fraternity. Several months ago his health made it necessary for him to retire from active life, and he went to Colorado. A wife and one son survive. He was a son of Rev. Dr. M. L. Berger.

Trade and Industrial Notes.

CUTTER'S MAST-ARMS IN THE M'S.—The George Cutter Company, of Chicago, reports large shipments of mast-arms to points in Manitoba, Maine and Mexico.

THE ELECTRIC APPLIANCE COMPANY, Chicago, report a steady increase in sales on all classes of electrical supplies. Their increase in sales of Packard transformers, however, easily leads the list.

THE ELECTRIC APPLIANCE COMPANY, Chicago, report enormously increased sales of Packard lamps. Their factory has just closed a contract with an eastern rapid transit company for 70,000 lamps.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., has issued Bulletin No. 1005, which is devoted to a brief description of the construction and features of their slow speed belt driven generators for electric light and electric power.

GEORGE KISSAM & CO., 253 Broadway, New York, the street car advertising agents, have issued a very handsome folder devoted to Niagara and Buffalo, and giving an excellent idea of the topography of the coming Pan-American Exposition.

JOHN T. NOYE MANUFACTURING COMPANY.—All the machinery, property, furniture, etc., of this concern is to be sold by the receiver at their office, 50 Lake View Avenue, on Nov. 15, at 11 a. m., by order of the Supreme Court of Erie County.

THE COLUMBIA INCANDESCENT LAMP COMPANY, St. Louis, Mo., is distributing to the trade a blotter, on the upper face of which is a half-tone illustration entitled "The Two Winners." The picture represents a Columbia lamp and the yacht Columbia.

THE CENTRAL ELECTRIC COMPANY, Chicago, reports that sales of Okonite wire are showing a pleasing increase. This condition arises both from the fact that electric work is now entering into inside wiring and the times are so much better that inferior material is not wanted when material of positive reliability can be had.

NOISELESS PINIONS.—The New Process Raw Hide Company, Syracuse, N. Y., has issued a leaflet addressed to manufacturers of motor vehicles. It points out the advantages of its rawhide pinions for automobiles. These gears are noiseless and durable, and for these reasons in particular are recommended as especially adapted for such use.

ELECTRIC STORAGE BATTERY COMPANY have recently issued a bulletin, illustrated, devoted to a description of the plant in the Bell telephone exchange at Philadelphia. This plant was also described and illustrated not long ago in these pages. It gives a good idea of the useful part that storage batteries can play in telephone work.

MR. A. B. LAURENCE, manager in New York for the Shultz Belting Company, has secured contracts for belting this month from the Salts Textile Manufacturing Company, Bridgeport, Conn., and the Alexander Dye Works, Lodi, N. J. The belts are to be Shultz sable rawhide, the largest in the dye works being 30-inch and in the textile factory 24-inch.

DIVIDEND PAYERS.—Under the general title of "Our Dividend Payers," the North Electric Company, of Cleveland, Ohio, has issued a set of three pamphlets, describing the farmers' community telephone system and the small telephone switchboards and telephone and cable protectors manufactured by this concern. The pamphlets are appropriately illustrated.

DRAFT WITHOUT A CHIMNEY.—Some months ago the B. F. Sturtevant Company, of Boston, in a neat little pamphlet, entitled "Draft Without a Chimney," presented their experience with mechanical draft, and pointed out its salient advantages. The demand for information has necessitated the publication of a third edition, which has just been issued, and may be had upon application.

FACTORY ELECTRICAL EQUIPMENT.—The electrical equipment of the new jewelry factory of F. H. Richardson, Newark, N. J., is completed and will be put into regular service immediately. It consists of two American-Ball duplex compound engines and 50-kw direct connected generators, furnished by the American Engine Company of Bound Brook. These machines will furnish power by electrical transmission to all floors of the new building.

THE UNION BOILER TUBE CLEANER COMPANY, 258 Penn Avenue, Pittsburg, Pa., has completed a contract for cleaning two Hazelton or porcupine boilers having over 2000 tubes, one end of which is welded tight. These tubes were badly scaled and the closed end required a special tool of unique design as well as the use of the flexible shaft. This concern claims to be the only one in the world that is fully equipped with machinery, tools and expert operators to do this kind of work quickly, effectively and cheaply.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, selling agents for the Adams-Bagnall enclosed arc lamps for all circuits, states that its factory, after exhaustive experiments covering a period of over two years, has become convinced that the heavy pressed copper as supplied by the Adams-Bagnall Company for arc lamp cases, is the most practical and natural covering for an arc lamp. Such a case, made up in the form adopted by the Adams-Bagnall Company, embodies rigidity, indestructibility and light weight. The Western Electrical Supply Company reports that the calls for the heavy pressed copper case lamp are decidedly on the increase.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED OCT. 31, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

635,739. ARMATURE FOR DYNAMO ELECTRIC MACHINES; S. Bergmann, New York, N. Y. App. filed Nov. 15, 1898. (See Current News and Notes.)

635,740. ELECTRIC ARC LAMP; S. Bergmann, New York. App. filed Nov. 25, 1898. The upper carbon holder runs in a tube and is electrically connected with the main frame by a flexible conductor wound helically around the tube and connected at one end with the tube and at the other end with the carbon holder, the tube being slotted to admit the end of the flexible conductor.

635,765. ELECTRIC SIGNAL; H. T. Gibbs, Portsmouth, R. I. App. filed Feb. 9, 1899. This is a signal for trolley roads in which the trolley wire is used as a part of the circuit, branches to the instruments being taken therefrom.

635,774. STORAGE BATTERY; A. Heinemann and W. Schafer, Berlin, Germany. App. filed Sept. 4, 1897. (See Current News and Notes.)

635,786. MEANS FOR REGULATING CONSTANT POTENTIAL TRANSFORMERS; W. A. Laymann and F. Schwedtmann, St. Louis, Mo. App. filed Feb. 27, 1899. This invention consists in the use of a constant potential transformer whose winding is built up in steps; automatically controlled regulating devices vary the amount of winding in actual use in proportion to the requirements. This device is so arranged that the current which flows in such portions of the windings as may be in use, will be maintained constant, being the amount required for the operation of the external circuit. The advantages claimed are that the current drawn from the dynamo has a high power factor and is in proportion to the translating devices in circuit; the circuit is at its maximum efficiency if no resistance is introduced to take the place of devices temporarily cut out, and the transformer is at its maximum efficiency as the losses therein are in a measure proportionate to the work being done.

635,812. TELEPHONE TRANSMITTER ARM; L. Schmidt, New York. App. filed Sept. 26, 1898. The arm consists essentially of two separated and insulated bars which are suitably joined to the instrument and to the wall piece, said bars forming a part of the circuit, thereby dispensing with the flexible cord commonly used.

635,814. STYLUS FOR PRODUCING ILLUMINATED SENTENCES; J. S. Scott, Toledo, Ohio. App. filed March 31, 1899. A slate is used having its writing surface covered by an opaque paint. By a peculiar construction of stylus the paint is rubbed off permitting the light of an incandescent lamp to show through the slate, while at the same time flashes may be given off by the stylus by controlling an electric circuit having its terminals at the stylus.

635,815. SYSTEM AND APPARATUS FOR CONTROLLING ELECTRIC VEHICLES; E. A. Sperry, Cleveland, Ohio. App. filed Sept. 6, 1898. (See Current News and Notes.)

635,816. SYSTEM AND APPARATUS FOR CONTROLLING VEHICLES; E. A. Sperry, Cleveland, Ohio. App. filed Sept. 17, 1898. (See Current News and Notes.)

635,819. ELECTRIC ARC LAMP; H. V. Swoboda, New York. App. filed Aug. 29, 1898. The electromagnets of an alternating current lamp are mounted upon springs to prevent the humming or chattering noise commonly heard in the operation of these lamps.

635,820. TELEGRAPHIC BLOCK SIGNAL SYSTEM; W. E. Taber, N. Collins, N. Y. App. filed July 2, 1898. The invention consists in the combination of a signaling mechanism, a telegraphic line, and means for making a ground connection or break in the line back of the sending instrument, and so connect it with the signal mechanism that the ground connection or break is made whenever the signal is set to any other than the danger position. The object is to render it impossible for an operator to report back the passage of a train until he has first set his signal to the danger position so as to block any approaching train.

635,833. CONDUIT ROD; F. S. Woodward, New York. App. filed Feb. 28, 1899. The rod is made in sections and is connected by joints which can be readily coupled and uncoupled in the confined space of a manhole.

635,851. ELECTRIC ARC LAMP; C. E. Harthan, Lynn, Mass. App. filed April 23, 1898. Structural details with reference to the connection between the magnet cores and clutch.

635,862. ELECTRIC ARC LAMP; E. S. Lea, Elwood, Ind. App. filed Aug. 8, 1898. Various improvements in the construction and arrangement of the feeding mechanism.

635,869. INSULATED PIPE COUPLING; G. Peeples, Washington, D. C. App. filed April 16, 1898. Details of construction.

635,880. SUMMATION METER; Elihu Thomson, Swampscott, Mass. App. filed June 20, 1898. (See Current News and Notes.)

635,881. ELECTRIC METER; E. Thomson, Swampscott, Mass. App. filed Sept. 2, 1898. (See Current News and Notes.)

635,910. ELECTRICAL INSTRUMENT; W. S. Boult, London, England. App. filed Dec. 30, 1897. In carrying out this invention the magnetic flux, due to the current passing around a core, is divided, part of it passing through another core against which the deflecting needle is for the moment lying and the other portion passing through the needle itself, and consequently magnetizing it in a sense similar to that of the adjacent core. Mutual repulsions take place between the core and needle and the needle flies away from the core and is brought back in any convenient way. The idea is to avoid reversing the polarity of the needle and to be able to work the needle through a large angle.

635,930. ELECTRIC CIGAR LIGHTER; F. H. Harriman, Hartford, Conn. App. filed March 29, 1898. The device is a pendant handle having a gravitating circuit closer inside which when the needle is lifted to be applied to the end of a cigar, closes the circuit and brings a resistance to incandescence.

635,944. COMBINED TELEPHONE AND PUSH BUTTON; B. F. Smith, Bay City, Mich. App. filed Nov. 26, 1897. A plunger carrying a button passes through the centre of the diaphragm and the core of the magnet immediately behind it. This may be operated to send in a call, after which another switch may be turned to throw the telephone into circuit.

635,950. DEVICE FOR PREVENTING FALSE ALARMS; T. W. Yale, Rochester, N. Y. App. filed March 24, 1899. Any person sending in an alarm becomes handcuffed to the box.

635,960. CONDUCTOR FOR CABLE TERMINAL; H. G. Grush, Boston, Mass. App. filed Aug. 24, 1899. The terminal consists of an impermeable sheath enclosing the conductors insulated with fibrous material for the principal part of the cable's length and with flexible waterproof insulation at their terminals which extend beyond the end of the sheath, a section of the waterproof insulation being tightly compressed by a winding or band and the sheath hermetically sealed thereto.

636,021. DEVICE FOR ELECTRICALLY ILLUMINATED SIGNS; W. T. Nottingham, England. App. filed Oct. 19, 1898. A circuit controlling drum operates in connection with a jacquard pattern.

636,023. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; J. R. Cravath, Chicago, Ill. App. filed May 4, 1898. (See Current News and Notes.)

636,028. ELECTRIC SYSTEM FOR AUTOMATICALLY GOVERNING POLYPHASE CIRCUIT BREAKERS; A. H. Engstrom, Philadelphia, Pa. App. filed Jan. 31, 1899. Consists in providing in connection with a polyphase motor having a field ring and an armature controlling the circuit breaker, a polyphase electric circuit and series transformers inside of the circuit adapted to set up a rotary magnetic field in the field ring, the armature being under the continuous but varying torque exerted by the field and a constant opposing torque exerted by a counterweight.

636,029. AUTOMATIC CIRCUIT BREAKING DEVICE FOR POLY-PHASE CURRENTS; A. H. Engstrom, Philadelphia, Pa. App. filed Jan. 31, 1899. In connection with the preceding system there is used mechanism controlled by the armature for operating the circuit breaker when the torque of the field overcomes the constant opposing torque on the armature.

636,030. CIRCUIT BREAKER; A. H. Engstrom, Philadelphia, Pa. App. filed Feb. 3, 1899. In this case there are provided a casing, a shaft arranged vertically within the same, a switch lever adapted to turn with the shaft, a nut adapted to be advanced on the shaft in one direction to confine the switch lever to the shaft, and elastic means interposed between the nut and the switch lever.

636,056. ELECTRIC LIGHTING GAS BURNER; R. C. Nourse, Boston, Mass. App. filed May 12, 1899. Details of construction.

636,057. ELECTRIC LIGHTING GAS BURNER; R. C. Nourse, Boston, Mass. App. filed May 21, 1899. Details of construction.

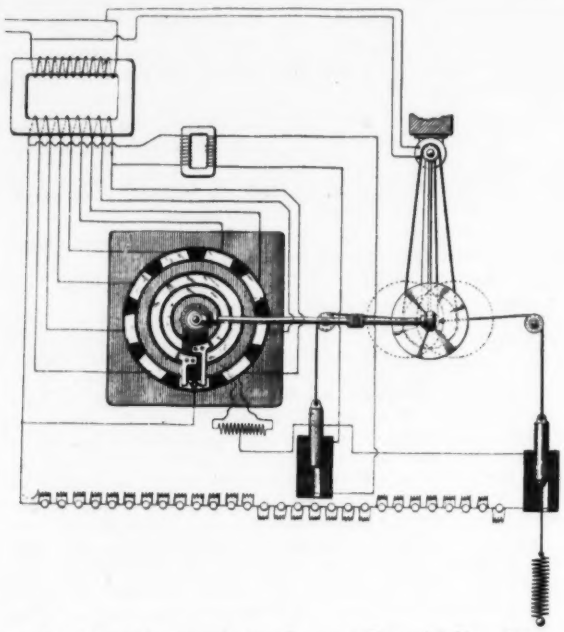
636,069. ELECTRIC BELL; D. Rousseau, New York. App. filed July 21, 1899. The working parts of this bell are arranged within the gong and its base. The principal feature is a short stroke armature lever acting upon the short arm of a pivoted hammer lever; thus a short stroke of the armature will give a long stroke of the hammer.

636,081. LIGHTNING ROD; H. J. Stuart and D. D. Woodman, Swain, New York. App. filed May 25, 1899. In connection with a lightning rod an automatic circuit breaker is used whereby an electric current is intermittently passed through the rod.

636,087. ELECTRIC MOTOR FOR FANS; G. A. Tower, Richmond, Va. App. filed July 20, 1899. A vertical support, a stationary field magnet attached thereto and having its upper side recessed to form an oil cup, the support extending downward into the oil cup, an armature carrier carrying an armature and a tubular shaft, this shaft embracing the central support and extending down into the oil cup.

636,089. BURGLAR ALARM; D. L. Wartzenluft, Kutztown, Pa. App. filed May 24, 1899. The wires of the circuit are stretched across the sash and hold circuit closers open.

636,090. AIR HEATER; E. R. Watermaan and R. Morrison, San Francisco, Cal. App. filed May 11, 1899. A tube through which air passes is surrounded by a heating resistance which in turn is enclosed in an insulating and non-heat conducting case.



635,786.—Means for Regulating Constant Potential Transformer.

636,091. FLUID HEATING APPARATUS; E. R. Watermann and R. Morrison, San Francisco, Cal. App. filed May 11, 1899. An electric heater is interposed between the double walls of a vessel.

636,093. ELECTRO-MEDICAL APPARATUS; W. L. Whitfield, Memphis, Tenn App. filed March 29, 1899. An electro-medical apparatus comprising a transformer having a magnetic area for enveloping the body or part to be treated and a secondary circuit arranged to carry current generated by the transformer, the terminals of which secondary circuit form contacts for the body or part treated.

636,097. ELECTRICAL MEASURING INSTRUMENT; V. Arcioni, Ivrea, Italy. App. filed May 10, 1899. (See Current News and Notes.)

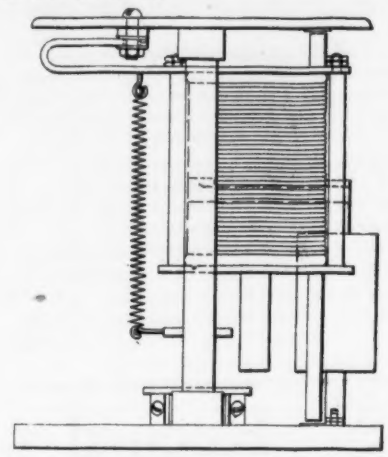
636,116. AUTOMATIC RELAY; F. E. Chapman, Medford, Mass. App. filed Aug. 27, 1896. A relay embodying in its construction an induction coil, an armature, a coil for the armature connected with and operated by the secondary of the induction coil, a local circuit including the armature, and means for preventing reverse signals in the local circuit due to changes of polarity of the primary circuit.

636,139. FIRE ALARM SIGNAL CIRCUIT; W. R. Hewett, San Francisco, Cal. App. filed March 28, 1899. An engine house local circuit containing gongs and releasing devices, branch circuits having different closing contacts, and a switch in the local circuit so arranged as to be normally closed to different closing contacts alternately, or to the said different closing contacts simultaneously, and so adjusted as not to be open at any position to all closing contacts simultaneously.

636,142. SECONDARY BATTERY; A. E. Hodgson, Halifax, England. App. filed July 31, 1899. (See Current News and Notes.)

636,182. ELECTRICAL MEASURING INSTRUMENT; F. W. Roller, New York, N. Y. App. filed Nov. 5, 1898. (See Current News and Notes.)

636,189. TROLLEY POLE; S. Vernay, Toronto, Canada. App. filed Jan. 20, 1899. The pole is tubular and branched at the upper end to carry two separate trolleys, the conductor from each running through the branch and then into the main tube to the car.



635,819.—Electric Arc Lamp.

636,203. ELECTRIC RESISTANCE; H. Helberger, Thalkirchen, Germany. App. filed April 19, 1898. (See Current News and Notes.)

636,229. MEANS FOR PLACING, REMOVING AND CLEANING ELECTRIC LAMPS; E. E. Simms, Albert Lea, Minn. App. filed Oct. 1, 1898. By means of this device lamps located in lofty places may be cleaned without removal from their sockets or may be easily removed from the sockets and replaced. The device is on the end of a pole.

11,780. (Reissue.) ELECTRICALLY PROPELLED VEHICLE; L. Krieger, Paris, France. App. for reissue filed June 20, 1899. (See Current News and Notes.)

GERMAN PATENTS, ISSUED OCT. 18, 1899.

[In Charge of Dr. Ralph Julian Sachers, 120 Liberty Street, New York.]

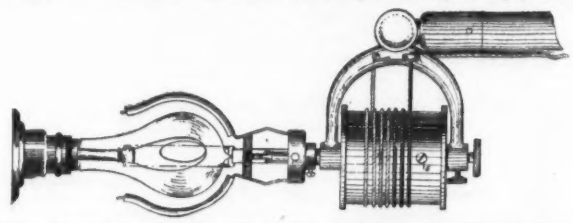
104,747. DEVICE FOR PRODUCING ELECTRICAL DISCHARGES WITHOUT LIGHT-EFFECT; Jonkheer Felix Louis Ortt, Im Haag. App. filed Sept. 2, 1898. This is an improvement on a prior plant and consists in having the knife-shaped dischargers provided with a toothed edge. A modification shows these teeth formed of a series of pins or needles, carried by suitable supports.

103,963. SAFETY FUSE FOR ELECTRICAL CIRCUITS; Allgemeine Elektricitäts Gesellschaft, Berlin. App. filed Sept. 30, 1898. The fuse-knob is provided with an outer annular rim, which, on screwing the knob into its base, presses against this base for the purpose of using the same style of knobs for fuses of different sensitiveness.

104,022. DEVICE TO PREVENT SPARKING; Actien-Gesellschaft Electricitäts Werke (O. L. Kummer & Co.), Nieder-Sedlitz, Dresden. App. filed Oct. 18, 1898. The side of the iron cores of the poles where the wire leaves the same is either partially cut away or provided with a suitable pole-piece, whereby a concentration of the lines of force on the exit-side, respectively a weakening of the field on the entrance side is prevented.

104,665. ELECTRIC STORAGE BATTERY; O. Lindner, Bruselles. App. filed May 29, 1898. The negative electrode consists of vertical alternately smooth and corrugated strips of lead, whereby the direction of the corrugations in the consecutive strips is changed. The positive electrode consists or angular alternately smooth and corrugated plates, placed horizontally one on the other. The object of this construction is to facilitate the escape of the gases and the circulation of the electrolyte.

104,666. CONSTRUCTION OF MIKANIT—RECEPTACLES FOR STORAGE BATTERIES; Hermann Jobben, Cologne. App. filed June 10, 1898. The two adjoining edges of the sides of a box are alternately beveled and cut away. The bevel of one side fits exactly in the cut-away portion of the adjoining side. The material mikanit being soft and plastic, the edges on hardening and drying become perfectly tight and the box is fire- and chemical-proof. Boxes with thicker walls are made by putting a number of boxes within another.



636,229.—Means for Placing, Removing and Cleaning Electric Lamps.

104,318. ELECTRIC BALL VALVE; Wilhelm Klinger, Berlin. App. filed Aug. 17, 1897. A ball, made of a magnetic metal, is pressed into the valve seat by means of a lever of the same material. On account of their magnetic property they are attracted to each other and secure the removal of the valve ball from the valve seat. A clutch on the lever prevents the ball from sticking too tight in its seat.

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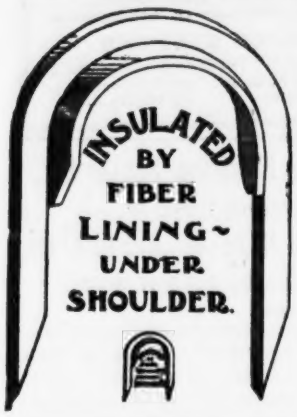

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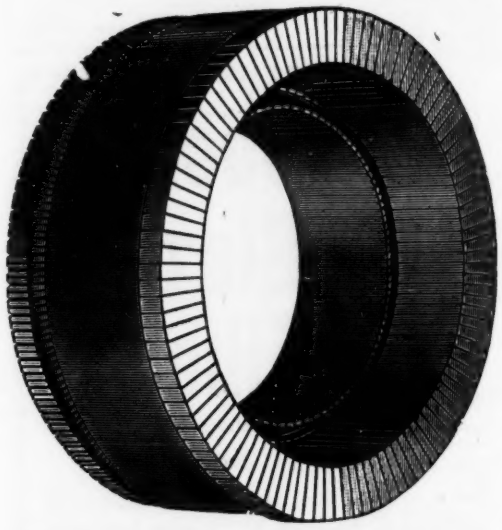

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